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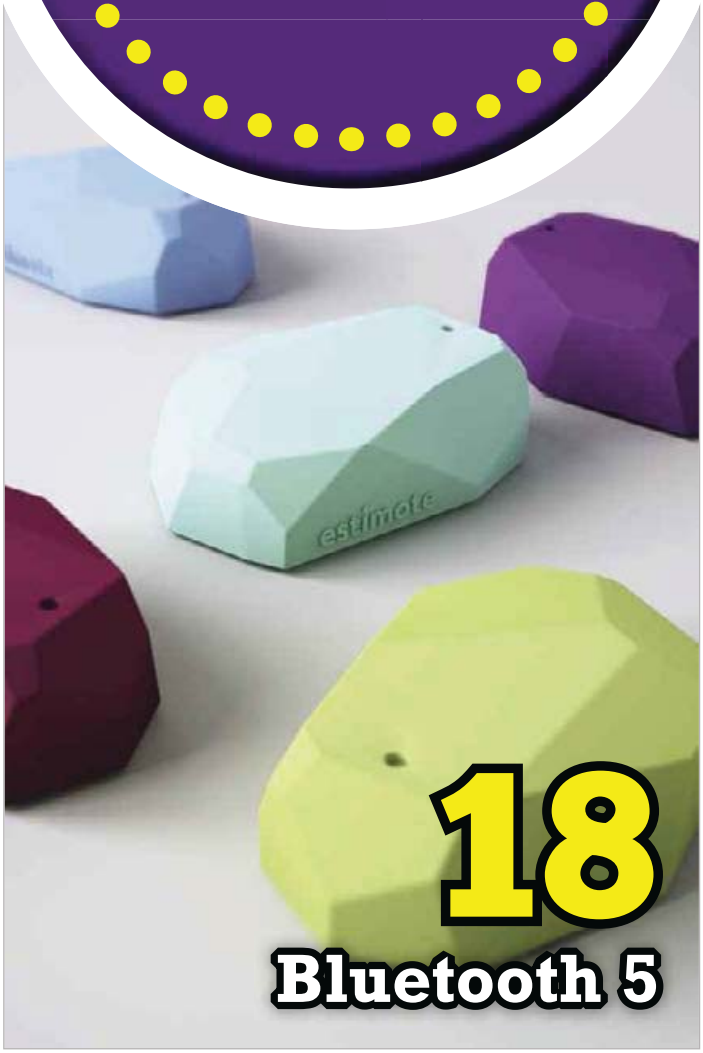

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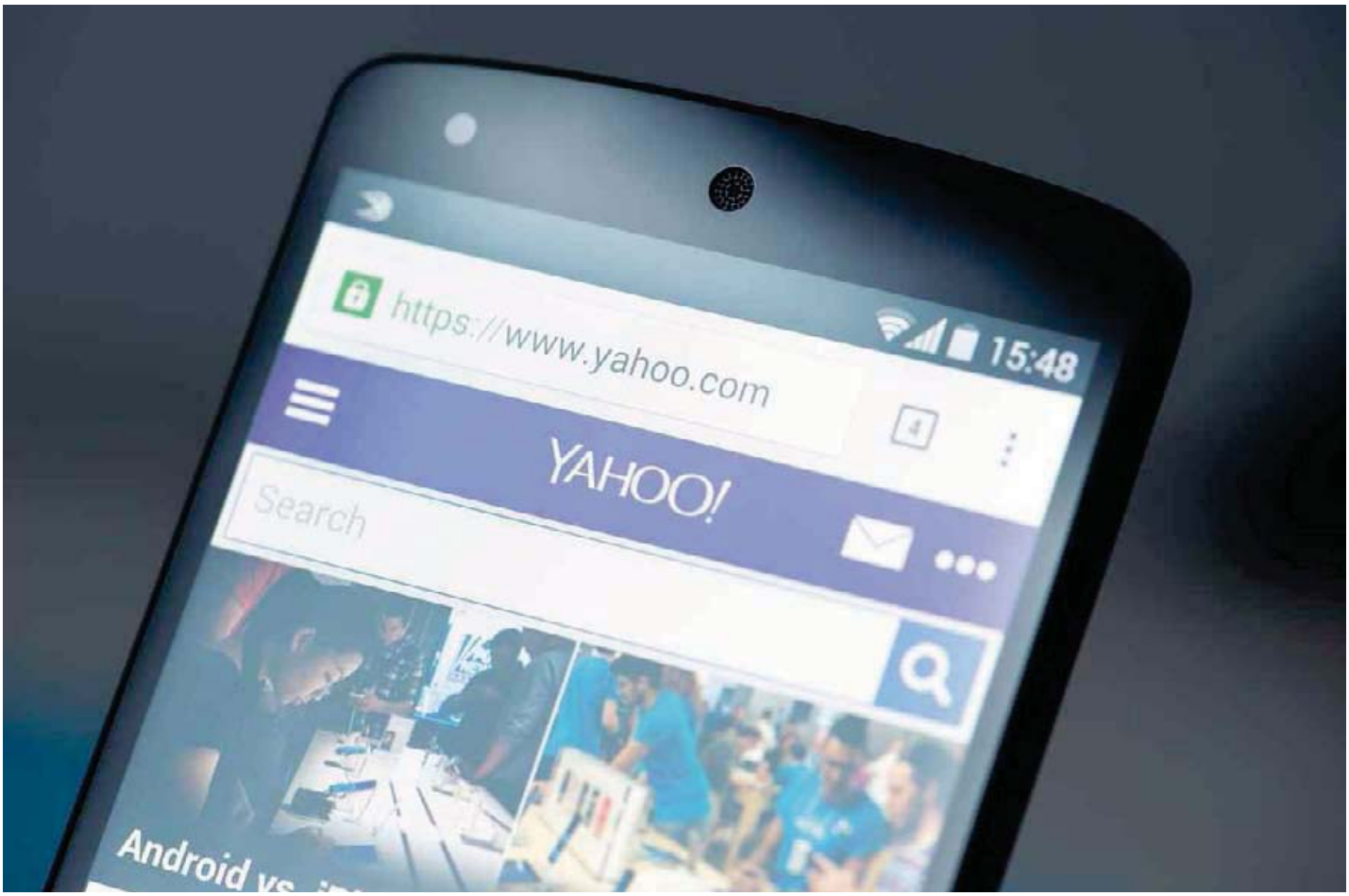


Yahoo!

Is it worth £5 billion?

Verizon has snapped up Yahoo! for $4.8 billion but is it money well spent? David Crookes takes a look

A few years ago, after spending pretty much the whole day searching and researching online, I asked a colleague what they thought we would do without Google. She turned around, looked me in the eye, shrugged her shoulders and answered: "Use Yahoo I guess."

As we got back to work, still chuckling heartily at the suggestion, I began to think about how the mighty had fallen. There was a time when Yahoo went head-to-head with Google – and maybe, just maybe, in some parallel universe, it has managed to steal a lead. Here on Planet Earth, though, Yahoo has long been seen as an also-ran. It even gave up on its own search engine four years ago.

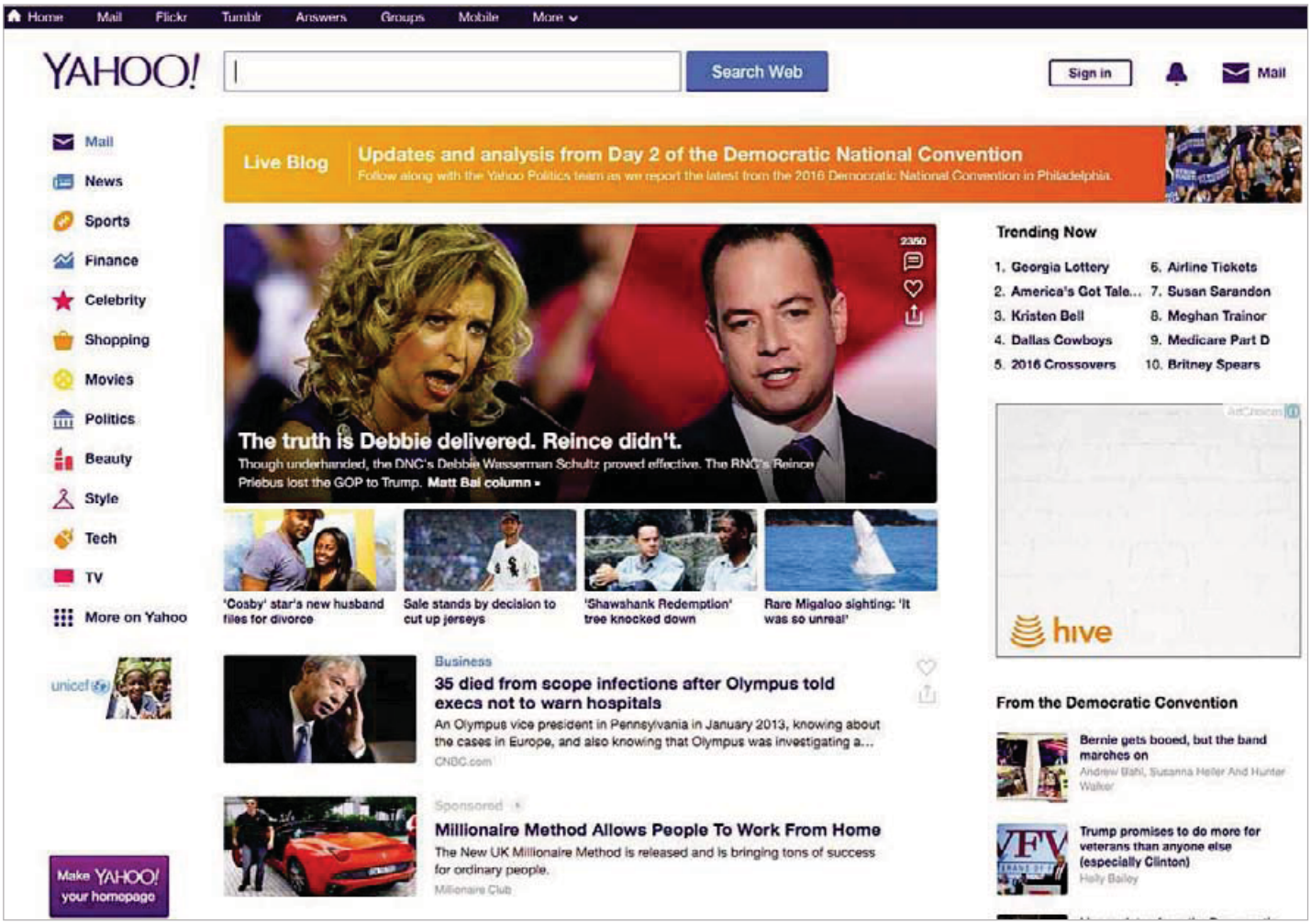
Things were certainly very different at the height of the dotcom boom when Yahoo, among many others that have since fallen by the wayside, was a very valuable company. It had been set up in January 1994 by Stanford University students Jerry Yang and David Filo as "Jerry's Guide to the World Wide Web", at a time when the internet was just starting to gather attention among computer users. The web looked promising and there were lots of stories about how it would put information at our fingertips and become a valuable educational resource, so Yang and Filo were hoping their little service would help people make sense of it. By March of that year, it was renamed Yahoo. Not too far down the line, it was valued at an eye-watering $125 billion.

It's worth putting that figure at the forefront of your mind before looking at what happened at the end of last month. In July, news began to filter through that Yahoo had agreed a deal with the American telecoms giant Verizon Communications and, as if to show just how the once-mighty had not merely fallen but landed with a gigantic bump, the sum involved was just $4.8 billion (£3.8bn) in cash. That's far less than the $45bn valuation Microsoft had placed on the company at back in 2008. Indeed, to put the deal well and truly into perspective, Google's parent company Alphabet is said to be worth around $560 billion – but then it, unlike Yahoo, didn't lose $440 million in the last quarter alone.

> **"At the height of the dotcom boom, Yahoo was a very valuable company"**

Wahoo For Yahoo?

So what is Verizon actually getting, and why does it even want Yahoo given how much its fortunes appear to have dipped? Well, the most important thing is that Yahoo, for all of its faults, still has some very popular services. As part of this deal, Verizon will be getting hold of its email division, the Tumblr social network, the news sites and Flickr – all forming part of the core of a company that has more than a billion active users each month. Verizon will also be getting hold of a rather lean and perhaps



efficient organisation that has been cutting itself back – first by slashing 15% of the workforce, second by shutting five non-US offices and third by closing seven digital magazines.

For Verizon, such a move puts Yahoo in a very good position. Yahoo fits into the company's overall plan, allowing it an extra leg up in the online market especially after it snapped up AOL for $4.4 billion last year. Indeed, just like with Yahoo, people questioned the wisdom of buying an organisation that had seemingly lost its mojo. Yet, while the AOL Time Warner deal – which was formed at a cost of $160 billion 15 years earlier – was seen as a flop, Verizon has been bolstered by its acquisition. The question over whether the deal with Yahoo is worth the sum that will be paid out for it will still need to be answered, however. After all, $4.8 billion is not a sum to be sneezed at, especially when there appears to be a lot of work to do. Investors will be paying attention.

> **"Yahoo kept its distance from Tumblr and allowed it to do its own thing"**

One person who thinks it will work out just fine is AOL's CEO Tim Armstrong. He told CNBC that Verizon was now capable of becoming a strong force in digital advertising, allowing it to transform into a major player in an online world dominated by Google and Facebook. He's not saying that Yahoo is likely to try and compete head-on in the search or social media market. Instead, it appears that Verizon wants access to behavioural data about Yahoo's customers and, as a combined force with AOL, will look use it to pave the way for more lucrative advertising on Yahoo News and Yahoo Sports.

This is all about content, content, content and achieving advertising dollars of the back of it. "Ad tech plus really strong content investments creates a very differentiated approach that consumers are willing to adopt and brands are willing to pay for," Armstrong told the US station.

Yet there is a flip side to this. Back in December 2015, *Business Insider* analysed the worth of Yahoo and it found that the core businesses was actually worth "less than $0". It came to that conclusion by noting Yahoo not only owned a

Dear Yahoos!

Yahoo CEO Marissa Mayers wrote to her employees to spell out what the Verizon purchase of the company meant. This is what she said.

Dear Yahoos,

Moments ago, we announced an agreement with Verizon to acquire Yahoo's operating business. This culminates a rigorous, thorough process over many months, and yields a great outcome for the company. Today's announcement not only brings us an important step toward separating Yahoo's operating business from our Asian asset equity stakes, it also presents exciting opportunities to accelerate Yahoo's transformation. Among the many entities that showed interest in Yahoo, Verizon believed most in the immense value we've created, and in what a combination could bring our users, our advertisers, and our partners.

This is a good moment to reflect on Yahoo's journey to date.

Yahoo is a company that changed the world. Before Yahoo, the Internet was a government research project. Yahoo humanized and popularized the web, email, search, real-time media, and more.

What really sets Yahoo apart is the shared passion to create great products for our 1B+ users, and in doing so, transforming the world for the better. You can clearly see that spirit, that commitment, that fight in the work we've done together over the past few years. We set out to transform this company – and we've made incredible progress. We counteracted many of the tectonic shifts of declining legacy businesses, and built a Yahoo that is unequivocally stronger, nimbler, and more modern. We tripled our mobile base to over 600 million monthly users, we invested in and built Mavens from basically zero in 2011 into $1.6B of GAAP Revenue in 2015, we streamlined and modernized every aspect of our consumer products, and, with Gemini and BrightRoll, we dramatically improved our advertiser products. This only scratches the surface of what we've achieved… and we all know how much hard work it took to get here.

It's because of that hard work and resilience, that Yahoo will realize amazing opportunities in its next chapter.

This sale is not only an important step in our plan to unlock shareholder value for Yahoo, it is also a great opportunity for Yahoo to build further distribution and accelerate our work in mobile, video, native advertising, and social. As one of the largest wireless and cable companies in the world, Verizon opens the door to extensive distribution opportunities. With more than 100 million wireless customers, a shared view of the importance of mobile and video ad tech, a deep content focus through AOL, Verizon brings clear synergies to the table. And with their aggressive aims to grow global audience to 2B users and $20B in revenue within the mobile-media business by 2020, Yahoo's products and brand will be central to achieving these goals. Joining forces with AOL and Verizon will help us achieve tremendous scale on ➤

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15% stake in a company called Alibaba that was worth $32 billion at the time but a 35.5% stake in the standalone public Japanese company, Yahoo Japan which was worth $9.7 billion. The combined $41 billion value jarred with Yahoo's market cap of $33 billion. Using simple maths, *Business Insider*'s conclusion was then that the core business was worth minus-$8 billion.

"Can Verizon and AOL make a difference to one of the most established of online names?"

In that light, it doesn't look such a good deal for Verizon. Yet, in the same article, analysts begged to differ with the report's simplistic valuation; instead, they put Yahoo's value more in the region of a positive $6 to $8 billion, based on the potential of the brands. That makes the amount Verizon spent something of a bargain.

So who's right, and what now for the company? Can Verizon and AOL help to make a difference to one of the most established of online names? Indeed, what is even going to happen to a Yahoo brand?

Growing Pains

The talk is that AOL and Yahoo will merge and this would make sense given that there is a good deal of shared outlook between the two. Currently, AOL remains as a standalone brand and its

mobile. Imagine the distribution challenges we will solve, the scale we will achieve, the products we will build, and the advertisers we will reach now with Mavens – it's incredibly compelling.

The strategic process has created a lot of uncertainty, but our incredibly loyal and dedicated employee base has stepped up to every challenge along the way. Through the first half of the year, we met our operational goals and overachieved on plan. But, further, there are things that you cannot measure, like the passion of the people behind the products. The teams here have not only built incredible products and technologies, but have built Yahoo into one of the most iconic, and universally well-liked companies in the world. One that continues to impact the lives of more than a billion people. I'm incredibly proud of everything that we've achieved, and I'm incredibly proud of our team. For me personally, I'm planning to stay. I love Yahoo, and I believe in all of you. It's important to me to see Yahoo into its next chapter.

As we work to close this agreement in Q1 2017, it's more important than ever that we come together as one global team to continue executing on our strategic plan through the remainder of the year. We have delivered the first half of the year with pride, achieving our goals. Now, it is up to us to make Yahoo's final quarters as an independent company count.

Yahoo is a company that changed the world. Now, we will continue to, with even greater scale, in combination with Verizon and AOL.

Thanks,
Marissa

portfolio includes some of the biggest web brands around from The Huffington Post to TechCrunch to Engadget. The days of providing dial-up services are well and truly gone, of course, and so AOL had spent a lot of time and effort investing in key brands and sites, something that has paid off.

Yahoo has had some major successes in this respect too. It may have had a spell between 2000 and 2004 when it used Google for search, but it has since tried to re-compete with that giant, offering unlimited email storage in 2007 and partnering with Yelp to boost local search results. Analysts have shown

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Yahoo to be the most-read news and media website in the world, and that's a true success. It's that kind of success that will have been attractive to Verizon.

Combining two companies with such a strong media position could be the shot-in-the-arm Yahoo's stalwart online brands need – in fact, there will be 25 brands in the overall portfolio all seemingly benefiting from a combined investment. "We have enormous respect for what Yahoo has accomplished: this transaction is about unleashing Yahoo's full potential, building upon our collective synergies, and strengthening and accelerating that growth," Armstrong said in a statement. "Combining Verizon, AOL and Yahoo will create a new powerful competitive rival in mobile media, and an open, scaled alternative offering for advertisers and publishers."

> **"Searches on Yahoo have been powered by Bing since 2012"**

Yet there are still lots of unanswered questions, chief among them the issue of who is going to head up the new combined division. According to Yahoo, it's too early to say whether Marissa Mayer will remain as CEO, decide to accept a new role at Verizon or leave altogether. Mayer appears to want to stay (her letter to staff, in the box out above, explicitly states this) and there has been talk of her turning down a $55 million severance payment at this stage to do so. She even wrote a post (on Tumblr, naturally) in which she addressed employees and said: "I'm incredibly proud of everything that we've achieved, and I'm incredibly proud of our team. For me personally, I'm planning to stay. I love Yahoo, and I believe in all of you. It's important to me to see Yahoo into its next chapter."

Armstrong seems keen to work with her too – the pair were once at Google together – but the whole situation appears to be under discussion. Yet there is another small matter to contend with. Verizon isn't buying absolutely everything that Yahoo owns: the asset equity stakes in the Asian e-commerce Alibaba Group and in Yahoo Japan are being separated off and will remain with the old business. If the remaining company wants to offload that, SoftBank – which owns the majority of Yahoo Japan and recently secured Cambridge chip designer ARM Holdings – has first refusal.

That's all in the realms of business and more of a side-issue than anything else, although it's worth pointing out that RemainCo – these assets are being referred to – is worth more than $40 billion. Yahoo did make some very good business decisions along the way.

Flicking Flickr?

Yet what all techies are most interested in is how the deal will affect certain Yahoo services and one of the biggest divisions to have a question mark hanging over it is Flickr. It was bought by Yahoo in 2004 for "somewhere between $22 million and $25 million", according to co-founder Stewart Butterfield in an interview with *Wired*, and it was big news at the time, showing confidence in the internet market once more. Butterfield went on to opine how innovation at Flickr soon declined after it was purchased and that it had a real battle on their hands with Yahoo as it tried to grab the right people and access to servers. He ended up leaving, but it didn't end the internal struggles.Part of the fallout from this was that it took ages for Flickr to emerge as a smartphone app, and it didn't work in the way it should have when it did arrive.

Things came to a head in 2012. Although Flickr had grown from a site with a million registered users to one that had around 87 million, there was a feeling that the actual service could be so much better. Mayer took over at Flickr personally,

The big hitters

Yahoo! is being sold for $4.8 billion. But how does it compare to other acquisitions?

AMOUNT	Company	Acquired by	When
$67 billion	EMC	Dell	2015
$26.2 billion	LinkedIn	Microsoft	2016
$22 billion	WhatsApp	Facebook	2014
$18.6 billion	Compaq	Hewlett-Packard	2002
$13.5 billion	Veritas	Symantec	2005
$12.5 billion	Motorola	Google	2011
$10.24 billion	Autonomy	Hewlett-Packard	2011
$8.56 billion	Skype	Microsoft	2011
$8.2 billion	Sun Microsystems	Oracle	2009
$7.2 billion	Nokia	Microsoft	2013

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prompting a website called **dearmarissamayer.com** to appear. "Dear Marissa Mayer," it said. "Please make Flickr awesome again. Love The Internet."

The service didn't become come back to life in the way that people seemed to want, though. Instead it began to struggle against growing competition from the likes of Instagram, a service that nailed mobile apps in a way that Flickr failed to do.

Does it have a future under Verizon? It's hard to tell, but we expect that it will become one of the casualties even though a Yahoo spokesman told *The Guardian*: "Flickr is one of the world's largest photo sharing communities and a platform for millions of people who have collectively uploaded more than 12.4bn photos. We remain focused on creating a destination for this community of photographers and people who love photos." If it does continue, though, it will have to up its game considerably if it wants to be loved by the core internet community again.

A better future should await Tumblr. Popular among millennials, and with a very invested community, Yahoo acquired the social link sharing network for a cool $1 billion in 2013. It currently has 555 million monthly views and more than 302.6 million blogs. It is said to be used by 65 million people, which may seem small fry in the grand scheme of things (Instagram has 400 million users and Snapchat 100 million), but solid investment would allow it to fulfil its potential.

One of the problems was that Yahoo kept its distance from Tumblr and allowed it to do its own thing, which meant it stopped growing on a service level. However, if Verizon can get its head around what Tumblr is – an easy way to share just about anything digital, and be a cross between a social network and a blog – it could become something even more special. There's certainly a strong sense of ownership: when Yahoo announced it was acquiring Tumblr, a petition attracted close to 170,000 signatures.

As well as these non-Yahoo branded sites, the company has lots of other services, from Yahoo Answers and Yahoo Groups – which stretch back as far as 1998 – to Yahoo Movies, Yahoo Music and the price comparison service, Yahoo Shopping. There's no way of knowing right now what lies ahead for them, but if they do close then they'll go the way of a host of other Yahoo services over the years.

Searches on Yahoo, for instance, have been powered by Bing since 2012, and there is a whole host of services that have either been closed or offloaded including del.icio.us, Kelkoo, Yahoo Auctions and Yahoo Maps, the last of which closed in June of last year. Yahoo has also been home to some names that spark great nostalgia: can anyone forget GeoCities, which had 38 million pages before it shut in 2009? It still exists in Japan, would you believe?

One thing is certain, it's all a far cry from where Yahoo was 10 years ago. At that time, it had managed to gain $1.9 billion in profit on revenues of $5.3 billion and it was buoyed up by advertising deals. Inherent problems were beginning to surface even back then, though. According to Reuters, senior executives got together in a hotel in San Jose in 2006 and were asked to write down what came into their head when various companies were made. "Search" people said when Google was mention and "auctions" for eBay – yet, for Yahoo, there was no real defining answer, which appeared to show a lack of focus on the part of the company and a feeling that it had put its fingers in too many pies.

This was made worse by some missed opportunities. Yahoo could have bought both Facebook and Skype, but it didn't. As Reuters points out – and as we mentioned earlier - it turned down a much better offer than is currently on the table when it stopped Microsoft buying it for $45bn eight years ago. At the time, it's co-founder Yang simply didn't want to sell it.

So now, as Mayers says, Yahoo enters a new chapter. The brand, given its strength, should live on just as AOL is doing and it should prove to be stronger in the new group than it was when it was alone. It's not a done deal just yet since it needs to be approved by regulators, but there doesn't appear to be any reason for it not to go through. The expectation is that the deal will be finalised in the first quarter of 2017 and, when it is, Yahoo will cease to be an independent company after 21 eventful years. Can it also cease being an also-ran and look to be a leader once again? Only time will tell! **mm**

Yahoo! United

Back in 2005 when Manchester United was looking for a sponsor to replace Vodafone, Yahoo! and Google were both understood to have been in the frame alongside Sony, Etihad Airways and LG. The deal was said to be worth up to £12 million for the club but it was AIG which eventually gained the rights from the 2006 season onwards. Yahoo!'s presence in the line-up, however, showed just how much of a player it was back then.

Other Suitors

"Verizon has confirmed it is buying out Yahoo Inc for a whopping $4.83 billion in cash, ending a lengthy sale process for the fading web pioneer," reported the *Daily Mail* when the news broke. Fading it may be, but that didn't deter Daily Mail & General Trust Plc from looking for partners to work with in a bid to snap up the company.

Yahoo had also attracted interest from Japanese online retailer Rakuten, Yellow Pages owner YP LLC and private equity companies such as Apax Partners, TPG Capital, Apollo Global Management and Warburg Pincus. It had been no secret that Yahoo would be available for sale and the saga had continued for months.

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What's New In Bluetooth 5

David Briddock reveals what the latest Bluetooth 5 standard means for tomorrow's technology

The Bluetooth standard has been in development for around 20 years now. This low-cost, low-power wireless technology is an attractive choice for a large and diverse range of applications (see boxout). Recent improvements in speed and functionality have only enhanced Bluetooth's appeal with device manufacturers and the tech buying public.

Yet there's always room for improvement. Speaking as chairman of the Bluetooth Special Interest Group (SIG), the committee that controls current and future specifications, Toby Nixon said there was "a significant demand" to enhance Bluetooth.

Talking about the new standard, Nixon said it would address two areas in particular, namely the fast-growing Internet of Things (IoT) domain and those low-power Bluetooth Beacons that are springing up in public places, shopping malls and high streets.

But what does Bluetooth 5 have to offer compared to the existing version? Before we look at the differences in detail, let's remind ourselves of what came in with Bluetooth 4.0.

Bluetooth 4.0

Bluetooth version 4.0 was adopted in 2010. After a few minor updates, discussed and agreed by the Bluetooth SIG members, the current version is 4.2 (**goo.gl/oKZCmX**).

Version 4 encompasses a rather confusing mix of names and wireless technologies: Bluetooth Classic, Bluetooth Smart, Bluetooth Low Energy (BLE) and Bluetooth High Speed. To provide some consumer clarity, the marketing focused on two brand names.

Bluetooth Smart Ready devices act as a hub or central device, meaning they can initiate and accept communication pairing requests with other Bluetooth devices. Typically, they'll incorporate a display plus a keyboard or touchscreen. Smart Ready examples include PCs, laptops, tablets, smartphones and smartwatches.

If a device has a Bluetooth Smart label, it acts as a peripheral device. These need to successfully pair with a Bluetooth Smart Ready hub before they can start doing something useful. They tend to be small, screen-less and keyboard-less devices, such as wireless headphones, smart toothbrushes, game controllers, environmental sensors and Beacon-based payment processors.

Version 5 Announcement

The Bluetooth development team announced the Bluetooth 5 specification in June (**bluetooth.com**). Note that in a break with tradition, it's not called 'v5.0', or even '5.0', but just '5'. The team hope this name change makes it clearer to consumers that this is already a robust and reliable technology.

As always with such a major release, it's been under construction for a few years. But manufacturers cannot start to implement a new standard until there is an official set of fixed and fully ratified specifications. However, this is now very close, as we'll talk about later.

Bluetooth is a big standard covering many different aspects of communication and security. Consequently, there's too much to cover in detail in a single article. Instead we'll concentrate on the key features of Bluetooth 5, as they're the ones that affect us the most.

Connectionless Data Transfers

Arguably the most significant and welcome news is that Bluetooth 5 has something called connectionless data transfers. This is all about adding flexibility to the device pairing process.

➤ *Bluetooth Beacons*

With wi-fi we just select a network, authenticate the connection, and then we're off. But with Bluetooth it's a little more involved. Both devices swap request information in a semi-manual handshaking process. This allows Bluetooth connections to be accepted or blocked by a target device.

While this process puts the user in control, it isn't always desirable or convenient. In contrast, Bluetooth 5 is smart enough to analyse the type of connection required based on transmitted information to deliver instant connectivity. It doesn't need a specific app to be installed. And there's no fiddly setup to configure.

With Bluetooth 5, manual pairing of your wireless headphones, keyboard or mouse should be a thing of the past, and wireless data transfer between a wide range of computing platforms should also become much a more streamlined process. This will be a boon to technology like Apple's AirDrop (available on iPhone and iPad since iOS 7) and similar developments that handle text, calendar, web-link and rich multi-media transfers.

Bluetooth 5 also enables automatic connection between our smartphones and those Bluetooth Beacons. This means, for example, we could be given directions to a favourite cafe chain in a foreign airport without having to set up a wi-fi or 4G connection.

Quadrupled Range

Bluetooth has always had rather limited transmission range, but with Bluetooth 5, the maximum theoretical range is quadrupled to around 300 metres.

This significant jump in range helps overcome existing communication boundaries, like walls and floors, just as it did when new wi-fi technology standards appeared. This means there'll soon be a real choice between wi-fi and Bluetooth communications in homes, cafes and workplaces.

However, transmission range is related to power, which is why it was limited in the first place. Maximising the range leads to significant power drain, so don't expect battery-powered mobile devices, like smartphones and smartwatches, to offer the same kind of range as mains powered PCs, home-hubs or Beacons.

Double The Speed

Version 5 was never going to slower than version 4. But the real news is that it's twice as fast as 4.2 – around 2Mbps in ideal conditions. While it's unlikely this maximum speed can be achieved in real-world environments, it's still going to make quite a difference.

Of course, it's not in the same league as a modern wi-fi connection, which typically throws data around at tens of megabits per second. Nevertheless, Bluetooth 5 now has the potential to handle small- to medium-sized downloads and software updates.

“This low-cost, low-power wireless technology is an attractive choice for a diverse range of applications”

When combined with the increased range we mentioned above, it gives Bluetooth 5 significantly more data transmission capacity. This is good news for mobile device owners.

Location Intelligence

As we hinted at earlier, one of the big drivers for Bluetooth 5 technology is the burgeoning deployment of info-transmitting Beacons. Located in shopping malls on the high-street and in other public places, these Beacons stream data to nearby devices carried by passing consumers.

Speed and range increases in Bluetooth 5 mean these Beacons can deliver much richer location-centric information. This data

Strange Name

Where did this unusual name come from? Well, before a formal name was agreed, Intel representatives suggested the codename Bluetooth, which actually comes from the 10th century second king of Denmark, King Harald Bluetooth, who was famous for uniting various tribes into a single kingdom.

SIG members, many of whom come from Scandinavia countries, thought it seemed an appropriate name for a short-range wireless technology intended to unite the PC and cellular industries. And when no alternative names were proposed, the Bluetooth name became official.

➤ *King Harald Bluetooth*

Bluetooth Automotive

includes navigation maps plus advertising, offers-of-the-day and other enticements from nearby businesses.

Bluetooth 5 enabled Beacons also benefit from heightened location sensitivity. This means improved mapping accuracy when providing directions – something that's of critical importance in our modern sprawling, multi-floor shopping centres.

Yet pinpoint location accuracy has many other commercial applications. For instance, warehouse managers and pickers would be able to pinpoint an inventory list item just by walking up and down the isles. And, once again, Apple will be a beneficiary in the form of its iBeacon technology, which sends alerts to iOS apps as you reach or leave a particular location.

IoT Ready

The Internet of Things, or IoT, is the title given to those diminutive, internet-connected devices. Appearing in homes, businesses, factories and across the wider environment they can control your central heating, monitor a production line, gather climate change data and lots more besides.

Wireless connectivity offers greater flexibility for IoT device deployment. For example, a single internet-connected device can converse with scores of other nearby devices wirelessly to build up an amalgamated data picture.

IoT is an area Bluetooth SIG committee were keen to address. Power conservation is a key factor in many types of IoT situations. Bluetooth version 5 has a number of under-the-hood tweaks and optimisations to deliver improved performance while drawing less power.

Another key IoT factor is Bluetooth's ubiquity. There are already more than eight billion Bluetooth-enabled devices in the world today – a number that will continue to rise sharply as long as computing and data storage costs continue their downward trend.

New Kit Required?

The development team has tried to ensure Bluetooth 5 will operate effectively on existing Bluetooth 4 compliant hardware. However, as you might guess, it's quite that simple.

It's very likely that re-engineered wireless chips are going to be required to take full advantage of the new specification's extra speed and range. In other words, existing devices may not benefit from the full potential of the Bluetooth 5 specification.

If true, this would mean a new range of 'Bluetooth 5 enhanced' mobile devices should hit the shelves around the turn of the year. Existing Bluetooth Beacons may also require an upgrade to take full advantage of the new features.

Bluetooth Classes

Bluetooth devices are divided into power classes based on power consumption and theoretical maximum range. Here's a definition of the Bluetooth 4.2 classes (Class 2 is the most common implementation):

Class	Max Range	Max Power Consumption
1	100 meters	100 megawatts
2	10 meters	2.5 megawatts
3	1 meter	1 megawatt
4	0.5 meter	0.5 megawatt

Interference from other airborne signals and local environmental conditions mean the real-world range is typically quite a bit smaller than specified. Even so, the Bluetooth 5 standard might lead to a new set of class definitions.

> **"Now Beacons will have eight times the broadcast messaging capacity plus pin-point location capabilities"**

Of course, this isn't great news for consumers. But Apple and all those Android-powered device manufacturers see this new standard as an opportunity, and they'll no doubt be touting Bluetooth 5 as a key element in their ongoing 'upgrade your smartphone/smartwatch now' marketing campaigns.

The Impact

Simpler device-to-device communication pairing, quadrupled range and doubled speed are features that can only benefit the next generation of computing devices. And it's mobile and wearable technology that should benefit the most.

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In The Beginning

During the 1990s, Ericsson employees Japp Haartsen and Sven Mattisson were investigating a short-range wireless replacement for serial data cables. Based in the company's Lund research labs, deep in the south of Sweden, they finally settled on short-wavelength UHF radio waves. Ranging from 2.4 to 2.485GHz these frequencies belong to the industrial, science and medical (ISM) radio band.

Their intention was to build a localised wireless personal area network (WPAN). Any PC or mobile device within range could join this network. To avoid the expected interference issues, they drafted a specification based around a frequency-hopping spread spectrum technique.

Ericsson's work soon attracted interest from big players in the personal computer and mobile phone arena, and in 1998, Ericsson teamed up with IBM, Intel, Toshiba and Nokia to form the Bluetooth Special Interest Group (SIG).

SIG was responsible for formalising the Bluetooth specifications, while also managing testing methodologies, the qualification program, licensing, marketing and trademark protection. Consequently, any licensed Bluetooth device has to adhere to the SIG specifications and standards.

Today, SIG membership is at an all time high of around 30,000 companies, who come from all parts of the globe. In addition to the biggest names in the computing industry, like Microsoft, Apple and Lenovo, there are many other organisations who operate in telecommunications, networking, consumer electronics, home automation, the automotive industry or health and fitness.

These members participate in Study Groups, Working Groups and Expert Groups. Study Groups perform research that informs the development of the Bluetooth specifications, and may eventually become Working Groups in their own right. Working Groups develop new Bluetooth specifications and enhance previously adopted specifications. Expert Groups deal with Bluetooth technical issues, reporting back to the Working Groups.

There's no doubt Bluetooth SIG members see a rosy future for Bluetooth 5, not just for technology consumers but also for industry, commerce, health care, science and numerous other arenas. Also, its inherent low cost is likely to hasten adoption across the developing world.

SIG executive director Mark Powell expressed this positivity when he said, "With the ability to broadcast a much richer set of information, Bluetooth 5 will make Beacons, location awareness and other connectionless services an even more relevant part of an effortless and seamless IoT experience."

Powell also commented on the IoT aspect of Bluetooth 5 when he said, "Bluetooth will be in more than one-third of all installed IoT devices by 2020. The drive and innovation of Bluetooth will ensure our technology continues to be the IoT solution of choice for all developers."

Bluetooth-enabled Beacons are a huge deployment area. Analysts at ABI Research have growth models that point to over 370 million installations by 2020. The Bluetooth 5 standard will be a key driver for this growth, because now Beacons will have eight times the broadcast messaging capacity plus pinpoint location capabilities.

▲ *Wireless headphones/speakers*

The Rollout

SIG plans to release the fully ratified Bluetooth 5 standard any time now, which means we can expect to see a new range of fully compliant devices appear during 2017.

This is probably too late to take full advantage of the surge in consumer spending that accompanies the festive period. However, it does mean there will be lots of Bluetooth 5 news at the Mobile World Congress (**mobileworldcongress.com**), the world's largest mobile industry gathering, which takes place in February each year.

By spring 2017, the shelves should be filling up with Bluetooth 5 compliant smartphones, tablets, smartwatches, fitness bands and other wearables. The 2017 range of desktop, laptop and 2-in-1 PCs will incorporate Bluetooth 5 chipsets by then too.

Keep a watchful eye on the technology adverts to see when Bluetooth 5 hits the features list. **mm**

Bluetooth Applications

- Hands-free mobile phone headsets.
- Wireless speakers.
- Automotive music and radio systems.
- Automotive navigation systems.
- Mobile device remote-control.
- Mobile device data synchronisation.
- Wearable fitness device communication.
- Wireless networking (wi-fi alternative).
- Wireless keyboard and mouse.
- Wireless game-controllers.
- Wireless printers and scanners.
- Children's toys.
- Barcode scanners.
- Traffic control devices.
- Medical equipment.
- Information beacons.
- Advertising hoardings.
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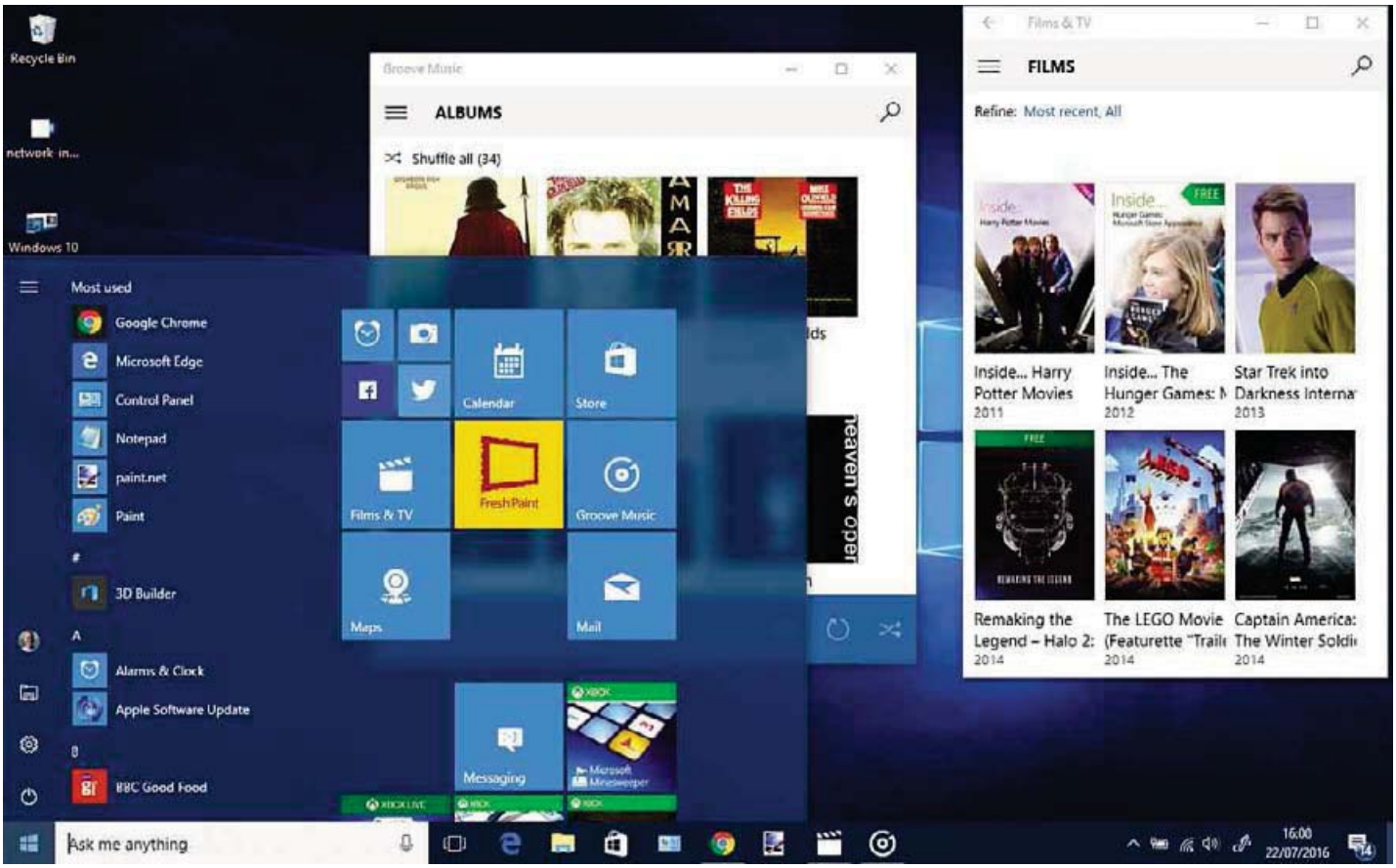


What's New In Windows 10 Anniversary Update?

Discover the new features in this operating system update. **Roland Waddilove** takes you on a guided tour

There is a new version of Windows 10, and if you don't already have it, you will very soon. Whether you like it or not, Windows 10 Anniversary Update will download to your PC and install itself – just try to stop it! That's another issue, though, but for those who have already made the jump to Windows 10 or plan to, there are some great new features to play around with in this summer 2016 update.

A lucky few will have received it on 2nd August, but there are something like 300 million Windows 10 installations, so it will not be possible to update them all immediately on that day. Don't worry if you haven't yet received the update, because you might have to wait days or even a week or two before it arrives on your PC. When it does, you will have lots of new features to try.

There are no major changes, and there is nothing like the massive differences between Windows 7 and 8, and 8 and 10. However, there are dozens of tweaks and changes throughout the operating system, and the total number must be in the hundreds. There are brand new features like Windows Ink Workspaces, updated features like the redesign of the Start menu, and numerous changes to the Settings app, which has been expanded by moving settings from elsewhere.

The Start menu has been redesigned and the apps list is always visible

A Fresh Start

The Start menu is probably the most obvious of all the new features in Windows 10 Anniversary Update. As soon as you click the Start button, the changes are apparent. The right side with the tiles is the same, but the left side with the menus is completely different. There is no link to the 'All apps' menu, because all your apps are listed all the time.

Click Start, and you can spin the mouse wheel or two-finger slide up/down on a laptop touchpad to scroll through all the modern apps and desktop programs installed on your computer. The apps list is alphabetically sorted as before, but it is on display all the time. This makes it easier and quicker to get to your apps.

The 'Most used' list of frequently used apps and programs is at the top of the new apps listing. Below this you might see a suggested app or two. Then there's the A-Z app listing. The old File Explorer, Settings, Power and username menus have been reduced to single icons on the left. A hamburger menu in the top-left corner expands a slide-out panel with full menus, which is similar to the way that mobile apps slide out a menu panel on the left. To power down, for example, you click Start, click the Power icon, and the old menu is there.

The tiles on the right look the same at first glance, but there is a new feature called chaseable tiles. Some tiles are able to show live information when they're set to medium or large sizes – right-click a tile and select More > Turn live tile on. A news app, for example, might show a series of news stories that changes every minute, so you can see what is happening without having to open the full app.

That's no different to the original Windows 10, but now the app can tell which item you clicked on when you click a tile. If you see a news story, for example, and want to know more, you could click the live tile, and the app would open with that story. It would mean you wouldn't need to open the app and then go and find the story. App developers need to build in the new feature, so your old dumb tiles will not suddenly become smart ones, but it's a simple tweak that will make live tiles more useful.

Top Tablet Tweaks

If you have a PC or laptop with a touch screen, a 2-in-1 with a tear-off screen or a Surface, tablet mode is useful. This is an alternative user interface that is similar to the original Windows 8 Start screen. The interface uses large app tiles – perfect for stubby fingers (it can be used with a mouse too). Click the notifications/Action Center button at the right side of the taskbar, and click Tablet Mode to access it.

A menu button in the top-left corner is used to slide out the Start menu, but the interface has been tweaked, and now there's a strip of icons down the left edge of the screen. The hamburger menu opens the side panel, showing full menus, but everything can be accessed using the icons anyway. There are two at the top to switch between tiles and All apps. It is very similar to the two tiles and app list screens in Windows 8, and it's an improvement on the previous interface.

Icons at the bottom of the left edge mirror those on the Start menu and show your account, File Explorer, Settings and Power.

Cortana Unlocked

Cortana is now smarter and can do more than it could before. One example is the way it can be enabled on the lock screen. Your PC can be locked when it's idle and the screensaver kicks in, when it wakes from sleep, or if you press Windows+L. Even though the desktop and apps cannot be accessed without logging in, Cortana is listening and can perform actions for you.

From the lock screen you can ask Cortana what the weather forecast is, you can ask Cortana to create an appointment or to move one from one time or day to another, you can list your appointments, and perform many of the other tasks that Cortana can do when you're logged in.

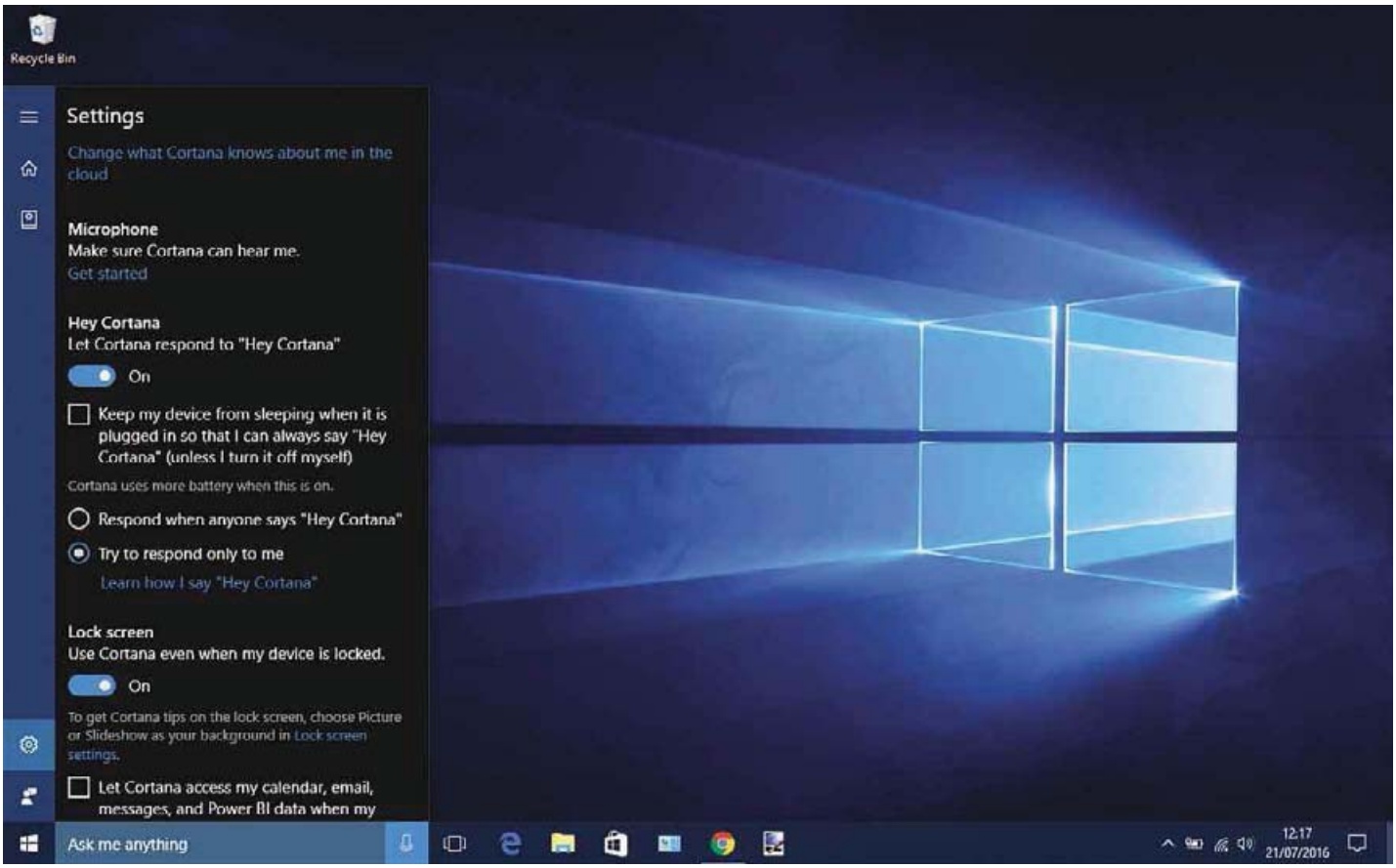
This is obviously a potential a security risk, because when you're not around someone could ask Cortana for information or get it to do things you don't want. However, there's an option in Cortana settings to respond only to your voice; you can also prevent it from accessing certain apps from the lock screen, such as email, calendar and messages. The feature can also be switched off completely, but it could be useful to you if you use Cortana a lot.

Windows Ink Workspace

Microsoft built Windows 10 with the ability to accept pen and touch input. The Microsoft Surface Pen is a pen-shaped gadget that has a tip at the sharp end, a button at the blunt end, and right-click and eraser buttons halfway down the barrel. It can be used to write on the screen, and the buttons can access various functions in apps. If you don't have a pen, but your laptop or monitor is touch-enabled, you can use your finger instead. It doesn't have the buttons and is a blunt writing tool, but it works.

Windows 10 Anniversary Update pulls together all the pen and touch features into what it calls Windows Ink Workspace. There's an extra button at the right side of the taskbar (right-click the taskbar and select Show Windows Ink Workspace button if it's hidden), which acts like a Start menu for ink apps.

Tablet mode has a menu button top left and two views buttons. This lists all apps



There are new Cortana settings and features. It now works on the lock screen

It's quite large, colourful and has Sticky Notes, Sketchpad and Screen Sketch tiles.

Sticky Notes, like any other sticky notes app (there has been one in Windows for years), allows you to can create notes with different colours and sizes and stick them to your desktop. However, you can write on these notes with a stylus or your fingertip. It's obviously best to use it with a tablet on a desk or on your lap, rather than a desktop monitor.

It's possible to create Cortana reminders from your notes, and checklists can be created too. It will be possible to write down a flight number, and Bing will automatically fetch the flight details. There are big plans for Sticky Notes, and not every feature may be ready at launch, but these and more are coming.

Screen Sketch takes a screenshot and then provides tools to enable you to write and draw on it using a pen or your finger. There's a pen, pencil and highlighter with colour palettes, a crop tool, save and share facilities. This is a useful feature for annotating things, and it's similar to the way that you can draw on web pages in Edge to annotate them. Sketchpad is a drawing app that offers the same features, but you start with a blank white screen instead of a screenshot.

Pen owners complained that it was hard to find apps that supported it, but this has now been addressed. In the Windows Ink Workspace menu is a list of recently used apps. There's a suggested app and a link to open the Windows Store and display a list of the apps that support Windows Ink.

Edging Forward

One day, Edge might be a great web browser, but so far it hasn't generated much interest among users, which is despite it being the default browser in Windows 10. One of the first things that people do after upgrading is to install an alternative browser or reset their favourite as the default. A lot of people just use Edge to get online and download Chrome or Firefox.

The Anniversary Update has an improved version of Edge that fixes some of the flaws in the original version. The main one is the lack of extensions that add extra features and functions to the browser. Extensions are extremely popular among users of Chrome and Firefox, which is why some people switched from Internet Explorer in Windows 7 and 8. To introduce a new browser in Windows 10 that didn't have extensions from the start was surely a mistake. That has been corrected.

Right now there are just a handful of extensions for Edge, but that's because there aren't many people with the latest version of Edge. Once people have installed the Anniversary Update and there

The new 'Start menu' for Windows Ink Workspaces. Apps are designed for pen and touch

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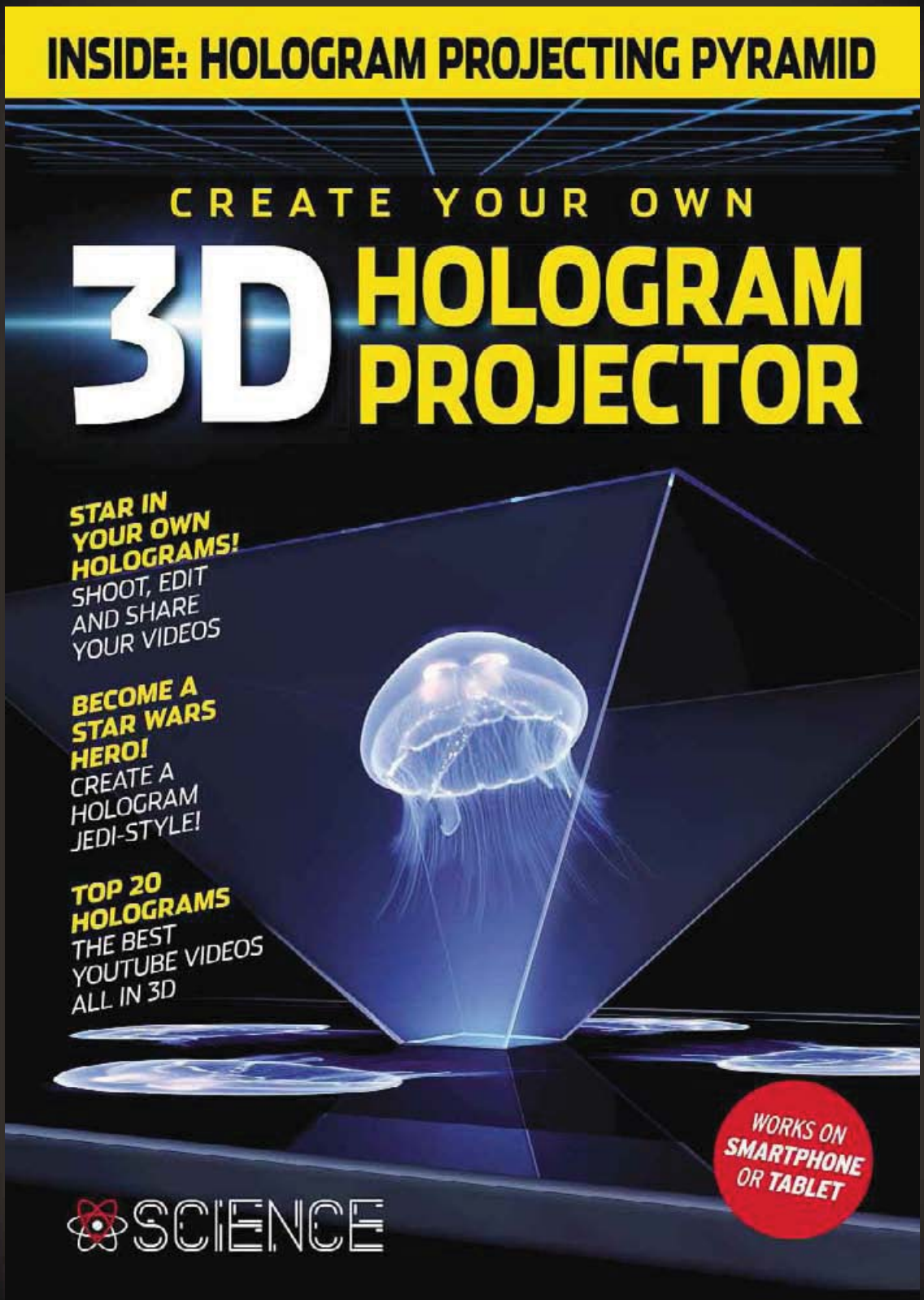

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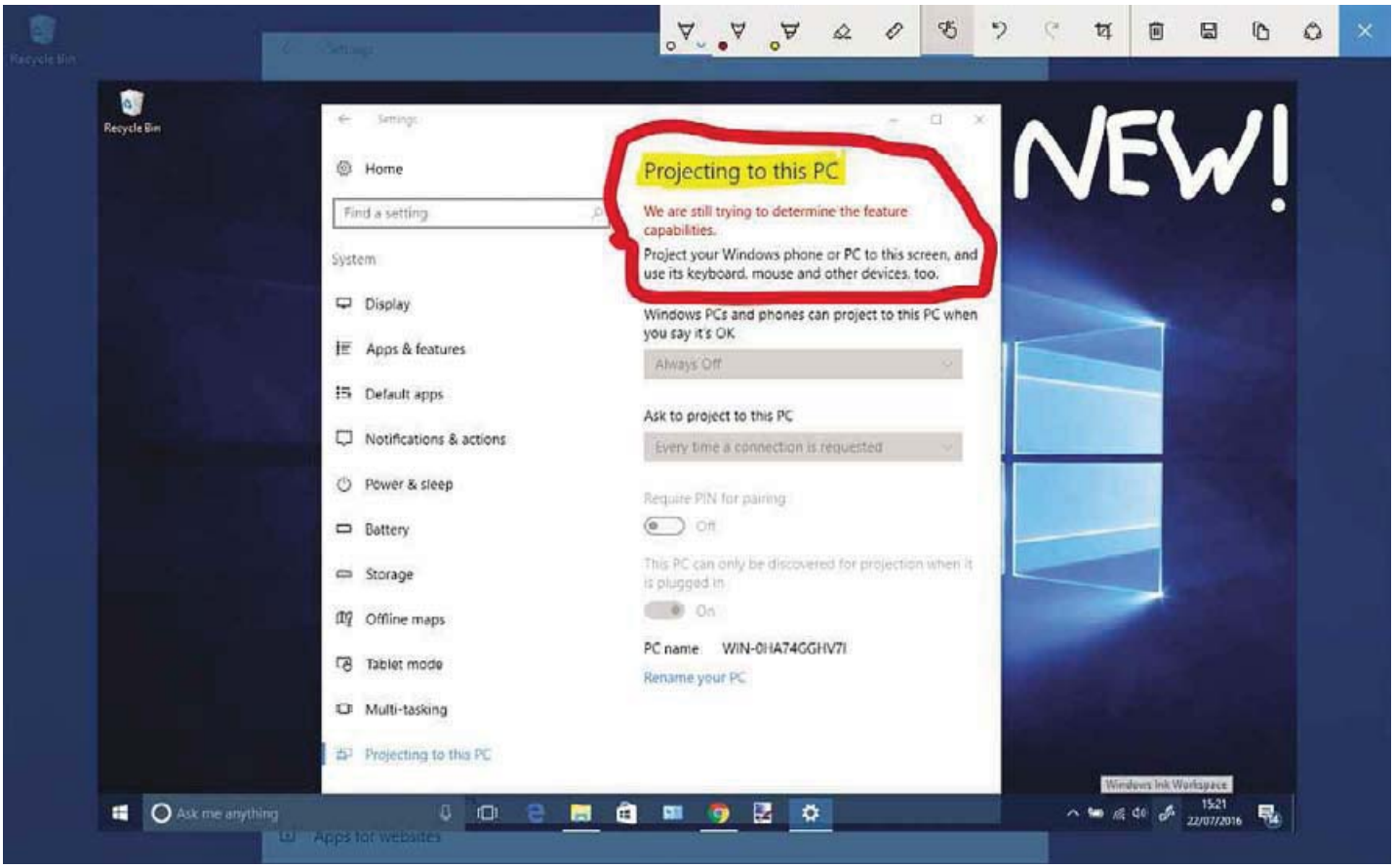


Screen Sketch takes a screenshot and lets you draw, highlight and write on it

are a few million potential users, developers might be tempted to convert some of their Chrome and Firefox extensions to Edge. So far, there's AdBlock, AdBlock Plus, Amazon Assistant, Evernote Web Clipper, LastPass, Office Online, OneNote Web Clipper, Pinterest and a few others.

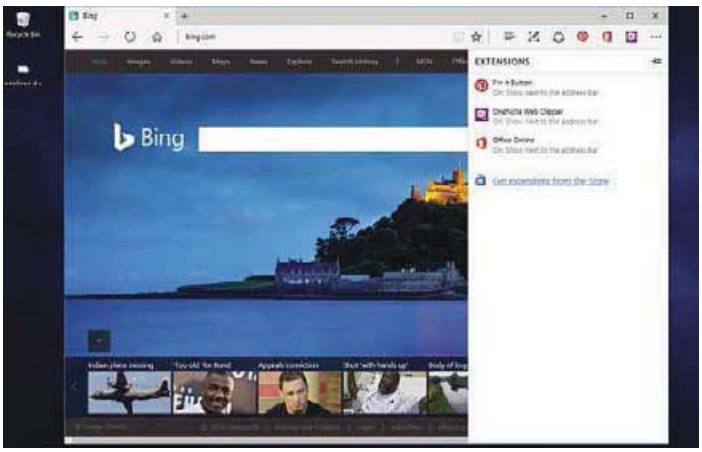
To find and install extensions in Edge, click the menu button and click Extensions. There's a link to open the Windows Store app, which displays the Edge extensions. Click an extension, click the Free button, and it downloads and installs. Extensions can add a button to Edge's toolbar on the right or they can add a button to the menu. A row of icons appears at the top of the menu. This is a nice idea and you can keep your most used extensions in the toolbar where they're accessed with one click, and less used extensions can be on the menu, which is two clicks away. To enable or disable extensions, to uninstall them or to configure its settings, click the menu button and click Extensions. Mouse over an extension in the list and click the gear icon.

There are numerous other minor tweaks to Edge. For example, it supports swiping left and right to go forward or back through recent browsing history. That's useful for people with touch screens. If you use Dropbox, Google Drive or OneDrive, you can upload folders by dragging them to Edge and dropping them. Show the Favourites panel, and there is an option to import bookmarks from another browser, like Chrome. Microsoft is clearly trying to make it easier to switch back to Edge.

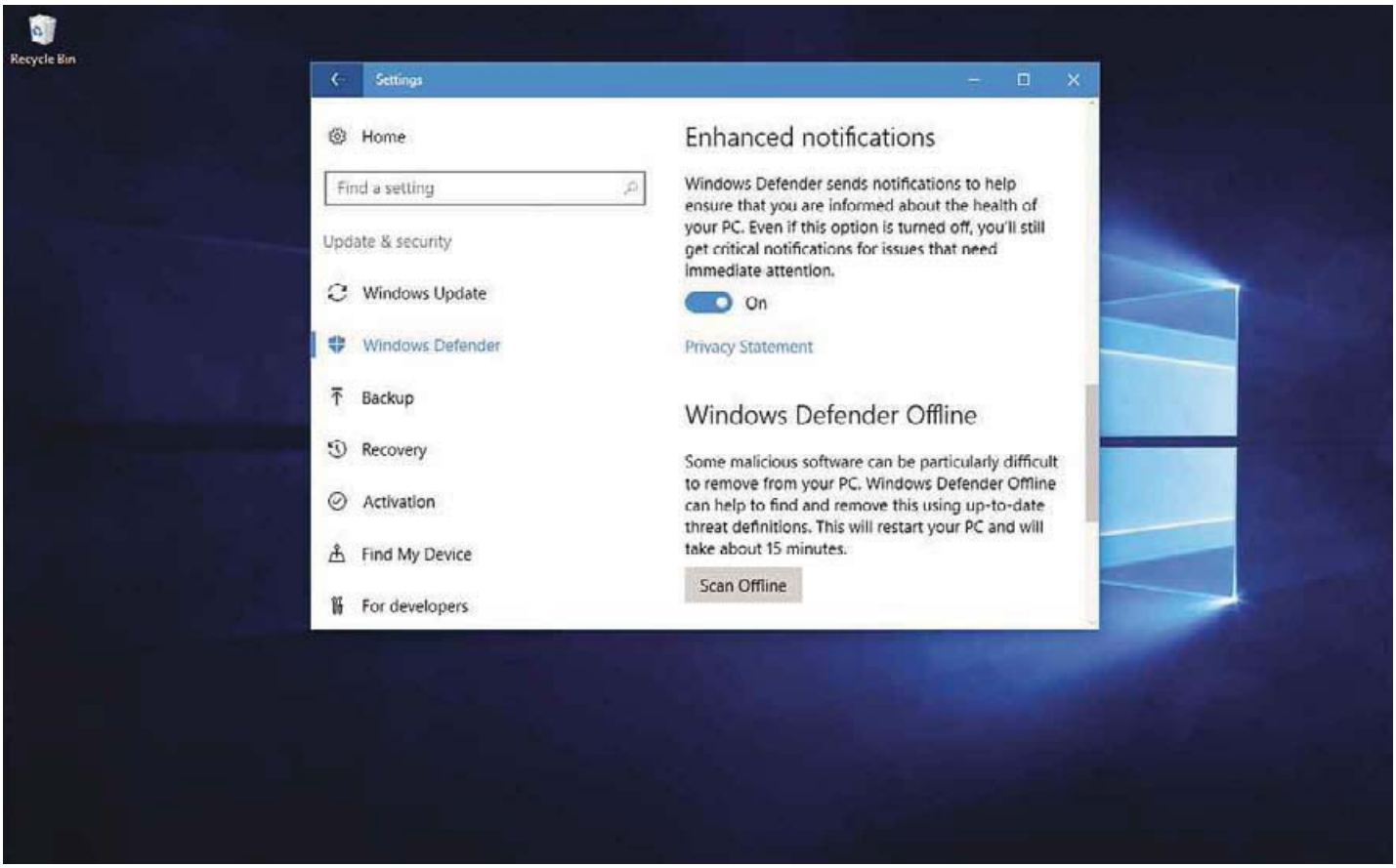
Windows Defender Now Offline

One of the first things people do with a new computer or new installation of Windows is to download security software, such as a free antivirus/anti-spyware tool or even a paid full security suite. However, Windows Defender has been steadily improving, and the latest version of Windows and Defender are more secure than ever.

Some types of malware are difficult to remove because when they're running in the background they can block any attempts to delete them, they can put back deleted files, and they can generally make it awkward to clean the system. To deal with hard-to-remove malware, there has been an offline version of Windows Defender for some time (**bit.ly/29T8p1l**). This is a special version of Defender that can run before Windows loads and before malware has loaded. To run Windows Defender Offline an .iso file must be downloaded and written to a CD-R. You then boot up with the disc and run Defender.



Extensions for Edge are thin on the ground, but we'll soon see many more



Windows Defender has a new offline scanning capability and extended notifications

The problems with this (apart from hardly anyone knowing about it) is it's a hassle to download and create the CD and boot from it. Windows 10 Anniversary Update has Windows Defender Offline built in. Go to Settings > Update and Security > Windows Defender, and you'll find a Scan Offline button. This shuts down Windows and restarts, and before Windows or malware loads, it scans and cleans your PC.

It's a huge improvement on the old method, and this, along with the ability to reset Windows in Settings, Update and Security, Recovery, means that more problems are more easily solved than with Windows 7.

Hello Windows

Windows Hello enables you to log into Windows without using a password, and it makes use of other biometric attributes, such as your fingerprint, iris or face. Not all PCs support it, because certain hardware is required, such as a fingerprint reader, but if your PC is capable and you have already set this up, then Windows Hello goes further than before. You'll be able to sign into your computer, apps and services just by sitting in front of your PC or placing a finger on the reader.

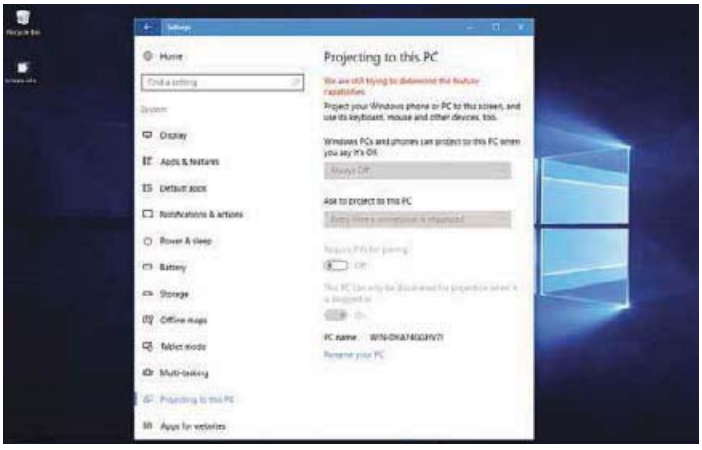
New Settings

The Settings app has been updated, and there are a large number of small changes. It looks different, and new icons have been added, new menu options have been created, and new settings included. There's now more in the Settings app, and the new menus and options make it easier to configure the way Windows works.

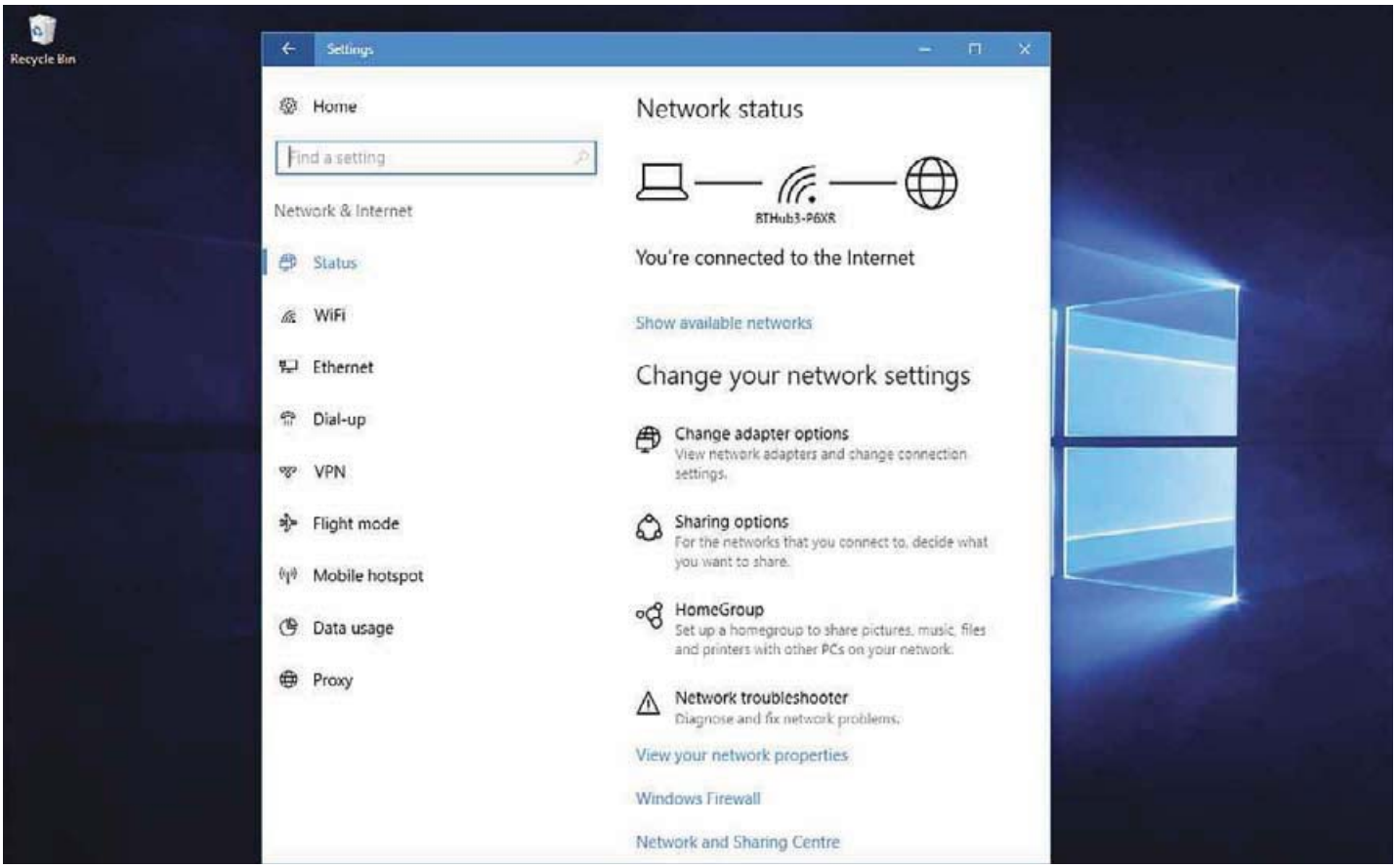
Microsoft started moving configuration options to Settings with Windows 8, and it was a confusing mess where some settings were in the Settings app, some in the Control Panel and others in various pop-up windows. In Windows 10, Microsoft moved more items from the Control Panel and dedicated windows to the Settings app, and in the Anniversary Update several more items have been moved to it. At the speed Microsoft is working, it might take ten years for everything to be migrated to Settings, though.

As an example of moved settings, right-clicking the taskbar and selecting Properties used to open a small window with configuration options for the taskbar and other things. In the Anniversary Update, Properties has been renamed Settings, and the Settings app opens with taskbar options.

It's impossible to list all the changes in Settings, so here are just a few highlights. There's a new 'Projecting to this PC' section, which enables Windows PCs and phones to project to your computer. Two weeks before the release date of Anniversary Update, this is



Settings has rearranged categories, new icons and several new features



Many parts of Settings have had a makeover. Here is the new Network & Internet

still a work in progress and not enabled. It's not clear what it might be useful for.

Network & Internet has had a significant makeover and is now much simpler to use. It presents more information about the status of networking, and provides access to features that were either hard to find or placed elsewhere in Windows previously. The initial Status display shows whether you're connected to the internet and how.

There's a Mobile Hotspot section that enables your PC's internet connection to be shared with other PCs, phones and tablets. You need to have a wired internet connection, such as a LAN cable to a router, but then your PC's wi-fi becomes a hotspot any device can connect to.

QR Code Fixes

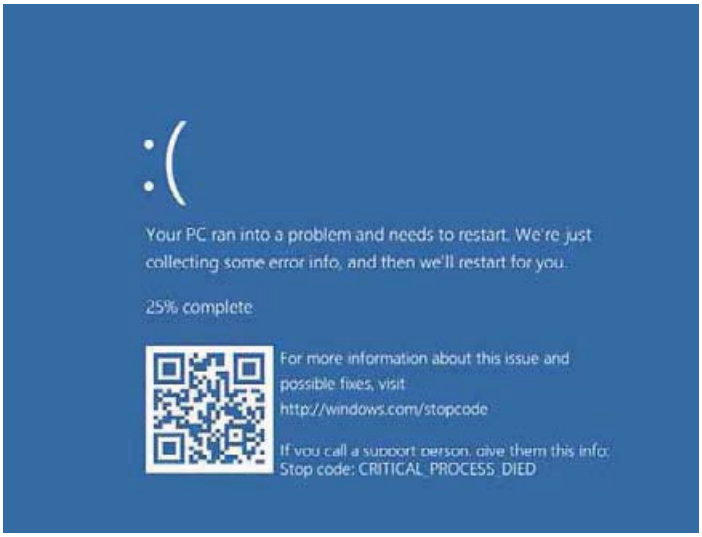
Windows is famous (or, indeed, infamous) for the blue screen of death. It's actually a lot less common than it used to be, rarely making an appearance these days. In fact, some people never see it.

There have been reports that it has had a makeover, and when the blue screen appears, it displays a QR code. The idea, presumably, is that you can snap this with your phone, and it will take you to a website where you can get help. Panda Security pointed out that it would be an easy task for malware to display a fake screen with a QR code that sent you to a malicious website that installed more malware or prompted you to enter personal information like usernames and passwords. You might want to ignore the QR code if you ever see it.

The Verdict

The Anniversary Update has lots of new features and interface tweaks, and it offers many improvements on the original Windows 10. In fact, it makes the original look clunky and poor. It's much improved, and if you haven't yet upgraded to Windows 10, then it is about time you considered it. Microsoft's latest OS looks good and is packed with features. Also, it works well and is fast too.

It's becoming a great operating system and, you know what they say: every other OS from Microsoft is the one to get – Windows 98 (not ME), Windows XP (not Vista), Windows 7 (not 8) and now Windows 10. Microsoft has produced a winner again! **mm**



Panda Security worries that this new BSOD screen can be faked by malware

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Remembering... Amstrad CPC 464

We recall a home computer that could hold its own against the 8-bit machines

When Alan Sugar's Amstrad bought out the Sinclair brand, the 8-bit world gave a bit of a shudder. After all, our precious Spectrum was now part of that company that made those strange, really long computers with the funny green screens.

Amstrad, it can be said, had its fair share of animosity from the user base, but looking back, in the cold light of maturity, the CPC was a really good home computer.

Admittedly, I never owned one, but a friend of mine did, while I had a Spectrum. Looking back, there was a certain level of envy associated with the CPC464 crowd. The playground was cut down the middle with a silicon curtain: Spectrum on one side and the Commodore on the other. When asked which computer was king, the reply could have started off a playground war. The Amstrad users, though, simply shrugged their collective shoulders and stated their preference, and they were left alone.

Looking at the CPC464, it was an intelligent design. With just two components (keyboard and monitor), users had a simplistic, self-contained unit – no ugly power packs, and just a single plug from the monitor.

It was reasonably priced too, with the green screen model coming in at around £199 and the colour option at £299. There's little wonder it was popular to begin with. The *Evening Standard*, announcing the launch of the Amstrad CPC 464, even labelled it as 'the People's Computer' likening it to the VW Beetle.

Its History

The Amstrad CPC 464 was launched on 12th April 1984. This was Amstrad's first foray into the fledgling home computer world, and it was a long way from its humble beginnings in 1968 and Alan Sugar selling car aerials from a van in the East End.

Amstrad already had a good reputation with its consumer hi-fis, self-contained units that were dirt cheap, but surprisingly well constructed. The idea behind the CPC 464, too, was well conceived. In Sugar's autobiography he says, "My concept was simple: Mum and Dad don't want little Johnny taking over the TV set, so our computer should come with its own monitor, have a full-sized keyboard and a built-in cassette mechanism for loading software and hit a target price of £199."

The initial project had its fair share of setbacks. Paul Kelly, one of the lead engineers for the project, had collapsed from exhaustion and left. And after five years of developmental hell, there still wasn't a recognisable computer.

After that, Amstrad brought in replacement engineers Roland Perry and William Poel. The duo were hired as consultants from their founded company, Ambit, and set to work creating the motherboard for the CPC 464 skeleton that was already developed.

After the CPC 464 was launched, its popularity helped fund a further five machines: the 664, the 6128, the 464Plus, the 6128Plus and a console, the GX4000. The company then moved into the PC market, with the Mega PC and followed with a number of technical flops. By 2007 the company was a shadow of its former self and was sold to BSkyB.

However, the CPC 464 is still a dominant machine in the retro scene and one of the best British home computers of all time.

Did You Know?

- Its development name was Arnold, an anagram of Roland Perry's first name.
- Production ceased in 1990.
- It had 27 colours across three modes: 160 x 200 16 colours mode0, 320 x 200 4 colours mode1, 640 x 200 2 colours mode2.
- It had a Zilog Z80 processor, hence the lazy Spectrum game ports.

The Good

Lots of memory and a decent colour screen. Also, it was easy to set up and use.

The Bad

The built-in tape deck was a bit dodgy at times. And there were some lazy game ports from the Spectrum. **mm**

The Amstrad CPC 464, a misunderstood machine that was overshadowed by the Spectrum and C64

One of the original adverts, this one selling the machine at a higher RRP

Component Watch

Adding Bluetooth to your PC is quick and easy with one of these USB adapters

When phones and laptops both support Bluetooth communication, it can be frustrating that your desktop system doesn't. Luckily, you can add that ability for around a tenner! This week we've looked at five different USB Bluetooth dongles that will give you access to your Bluetooth hardware and accessories, not to mention allowing wireless communication between your PC and portable devices. Not a bad deal at all.

Deal 1: Dynamode BT-USB-M2
RRP: £4.99 / Deal Price: £1.87

This super-cheap adapter is fully Bluetooth 2.0 compliant, which explains its low price – most modern devices use the more versatile Bluetooth 4.1 standard. Still, if you've got old devices that wouldn't benefit from a faster connection or want to save yourself a few quid at the expense of bandwidth, you won't find better than this.
Where to get it: Transparent – bit.ly/2ag5dNs

Deal 2: Trendnet TBW-107UB
RRP: £9.99 / Deal Price: £8.59

This Bluetooth 2.1 dongle is considerably more expensive than Dynamode's 2.0 version, but that .1 makes a lot of difference to compatibility. It supports seven simultaneous devices, has a 10-metre range and supports secure simple pairing, so it's easier to connect devices. At £7.19, it's still a bargain – small, discrete and ultra-compatible, its performance is far more reliable than unbranded alternatives, and ultimately that's a good reason to pay extra for it.
Where to get it: NetStoreDirect – bit.ly/2azE25E

Deal 3: Startech Mini USB Bluetooth Adapter
RRP: £11.99 / Deal Price: £8.68

Startech's version of a Bluetooth 4.0 adapter is available for only a little more than the Asus and Belkin version and offers many, if not all of the same features. All things considered, there's no particular reason to dismiss it, but reputation alone suggests that one of the others will probably have the edge. Startech is known for its budget networking hardware, and when you can find bigger brands at smaller prices, it's got little to recommend it. Despite that, if you can only find this, then there's no reason to actively avoid it. It actually works, and that already makes it better than any cheaper, unbranded adapters
Where to get it: Una Technology – bit.ly/2a26ufK

Deal 4: Belkin USB 4.0
RRP: £21.59 / Deal Price: £9.91

Belkin's adapter is normally a little overpriced, but if you shop around you can find it for a fantastic discount. Its Bluetooth 4.0 support is comprehensive, and the device itself is compact and compatible with both Mac and Windows systems. Normally far too expensive to recommend despite its strong brand name, if you're quick enough to catch this discount, then there's no question you should go for it!
Where to get it: CCL Online – bit.ly/2ax5i3w

Deal 5: Asus USB-BT400
RRP: £11.99 / Deal Price: £10.49

The kings of high-quality wireless peripherals at Asus bring their skills to this low-price Bluetooth 4.0 adapter. Backwards compatible with earlier versions of the standard, it supports Bluetooth Low-Energy (BLE) connections, as well as the superior connection speeds and range capabilities of its more advanced standards. Chances are if you're looking for a Bluetooth adapter, this is the one that does everything you want. The discount isn't huge, but the value definitely is.
Where to get it: Currys – bit.ly/2ak4vj7

Gorilla Glass Steps Up

Amazon Gets UK Pass For Drone Drops

Government partnership allows trials to go ahead

Is it a bird? Is it a plane? No, it's a small parcel. Amazon has announced that it's partnering with the UK government to "explore steps needed to make the delivery of parcels by small drones a reality". The "cross-government team", with support from the UK Civil Aviation Authority, has given Amazon the necessary permissions to explore some key areas of drone flight: beyond line of sight operations in rural and suburban areas, testing sensor performance to make sure the drones can identify and avoid obstacles, and flights where one person operates multiple highly automated drones.

That first point is key, as similar drone trials taking place in the US are mightily restricted, with commercial drone flights only allowed if the drone remains in the sight of its pilot. Clearly, the UK government is all too happy to boast about how it's leading in drone innovation and so forth, but the real news here is that this is a big boost for Amazon's future goal of delivering parcels to its customers within half an hour.

Where once we all had to mingle with other human beings in shops, there is a possible future where everything is delivered direct to our homes by low-flying drone craft. What a strange world we live in...

If you want to read all about Amazon's drone dreams, visit **www.amazon.com/primeair**.

QUICK BITS... Linux 4.7 has been let loose. Fill yer boots

Don’t crack up with next level of technology

Gorilla Glass, the super-strong screen adorning mobile devices, has gone up a level, and now the company behind it is saying it can survive more than 80% of drops from as high as five feet up.

Gorilla Glass 5 was tested on a variety of surfaces, and some of the handsets that Corning – the company behind the tech – tested in the lab actually survived over 20 drops, according to a report at the BBC. With most of us who drop phones in the real world doing so from much lower heights than five feet, the chances are that this technology could mean no more cracks – on our screens, at least.

Expect handsets using Gorilla Glass 5 to be demonstrated over the coming months.

BlackBerry Unveils ‘Most Secure’ Android Mobile

Company will not go quietly into the night

Good old BlackBerry. Here is a smartphone company that simply refuses to stop trying to turn around its fortunes, and we can only salute it for that.

Its latest smartphone release is the DTEK50, labelled as the “world’s most secure Android smartphone”, and this is BlackBerry’s second Android-powered phone following the PRIV. Equipped with Android Marshmallow 6.0, the DTEK50 is an all-touch design that has been developed in response to the increase in cybercrime on mobile handsets.

Among its features are rapid security patching, to stay ahead of the latest malicious threats; a secure boot process, which means each stage of the boot chain must verify that the next component is fully intact before proceeding (ensuring it hasn’t been tampered with since the last restart); and FIPS 140-2 compliant full disk encryption for data protection should the phone be lost or stolen. As for the actual hardware, this has a 5.2" scratch-resistant display, 13MP auto-focus camera, and micro-SD card support for up to 2TB.

Available for pre-order right now for £275 from **uk.blackberry.com**, whether or not this budget entry is of any interest will very much depend on how much you worry about security.

Many years ago, I had a Yahoo email address, and if I wanted to find something on the internet, I would use Yahoo. At the time, I found it far more effective than Lycos, Ask Jeeves and other search engines of the time. I'd also happily waste hours playing pool in Yahoo Games, and chatting to strangers from around the world as we knocked virtual pool balls around.

Then Google launched. This clean, to the point search engine did away with all the extras and made searching for things even easier than before. Pretty soon it became my default search provider.

I still had the email address for a while, but then it was replaced by Hotmail and eventually Gmail.

I'm not sure why I stopped playing Yahoo pool and stopped frequenting Yahoo Chat, but I did. Eventually, I wasn't using any of its services at all.

This is obviously a very brief and personal account of my experience with this company, but I suspect it's representative of many other users just like me. We slowly left and we never came back.

Now it's being sold, I wonder if the new owner will actually be able to make a difference?

Anthony

Meanwhile... On The Internet...

Spending any more than 20 minutes with somebody that could be considered 'millennial' (**tinyurl.com/MMnet25a**) or younger ('digital natives' we used to call 'em when I were a lad: **tinyurl.com/MMnet25b**) is likely to make anyone born before Live Aid (the first one: **tinyurl.com/MMnet25c**) feel about 10,000 years old in comparison. However, it may make you feel a little younger to know that the internet passed 'only' it's 10,000th day in existence last week (**tinyurl.com/MMnet25d**). Doesn't sound too bad, does it? We didn't think so either.

The date celebrated (28th July) marked that number of days since Tim Berners-Lee (he later became a Sir in 2004) first proposed the distributed information system that would become the web we know today (**tinyurl.com/MMnet25e**) on March 12th, 1989 (**tinyurl.com/MMnet25f**). Great days they were: Jason Donovan on top of the hit parade (**tinyurl.com/MMnet25g**), *Press Gang* on TV (**tinyurl.com/MMnet25h**), we'd not long been allowed to stay up and listen to Bruno v Tyson (**tinyurl.com/MMnet25i**), we were probably playing a version of *Shadow Of The Beast* (**tinyurl.com/MMnet25j**) that was totally 100% legit and not at all cracked ('cause we definitely had enough money burning a hole in our pockets to buy it) until we got a vague idea of what we were meant to do before getting annoyed and putting on *Stunt Car Racer* again, Liverpool and Arsenal were slugging it out at the top of Division 1 (**tinyurl.com/MMnet25k**)... Division 1, eh? Actually, that all feels a really, really long time ago now. Sorry.

Anyway, before we digress right up our own DNSs, back to that proposal. In what is probably one of the greatest margin notes of all time, Berners-Lee's boss at CERN, Mike Sendall, simply scribbled "Vague, but exciting..." at the top of the cover page of his *Information Management: A Proposal* document (**tinyurl.com/MMnet25l**). Though, at the time, that represented little more than a reserved stamp of approval and an indication that Berners-Lee should continue with is work, looking back it seems a surprisingly accurate way to describe what the proposal his idea would morph into 27 years, four months and 16 days down the line.

So thanks again, Tim, for everything; we think. Though you can definitely have Nyan Cat back, maybe... And Trolls (**tinyurl.com/MMnet25m**), and taking pictures of your food, spoilers, the billion passwords we now have to remember – and *10 Hours Of*... videos, too. Oh, and dial up... That was rubbish.

Politics on both sides of the Atlantic seems to be in a total mess at the moment, but at least the US can legitimately claim that what's going on in its Presidential election cycle is organised chaos. The last couple of weeks has seen both sides of the American political divide put on their big, set-piece conventions. Designed to be the final leg of the nominations trek that's seen candidates battle it out from coast-to-coast over the last 12 months, they usually work out more like glitzy set-piece rallying cries to supporters, designed to gird the loins for the battle to come.

While the Democratic Convention eventually got it's act together, and showed Bill Clinton the time of his life (**tinyurl.com/MMnet25n**), it was almost derailed by the hacking of its National Committee's servers (**tinyurl.com/MMnet25o**). This, in turn, led to the well-timed release of a whole trove of information by Wikileaks (**tinyurl.com/MMnet25p**), the fallout from which was a high-profile resignation by the committee's chief – having been embarrassed by the contents of emails that seemed to imply a bias towards the nomination of Hilary Clinton and against Bernie Sanders (**tinyurl.com/MMnet25q**).

Still rumbling on, as we write, is a full-blown 'Whodunnit?' (**tinyurl.com/MMnet25r**), which has seen the finger pointed roundly at Russian hackers (**tinyurl.com/MMnet25s**) – either working as a group independently or with state backing, despite denials from someone claiming to be 'Guccifer 2.0' (**tinyurl.com/MMnet25t**) and a less than convincing cry of 'no proof' from Wikileaks. Time, inevitably, will tell.

The Republicans, for their part, had internet-related problems of their own. This time, however, it was the eagle-eared denizens of Twitter, many of whom were quick to point out some interesting similarities between the speech made by Donald Trump's wife Melania (**tinyurl.com/MMnet25u**) and the speech given by Michelle Obama when her husband has just received the Democratic nomination in 2008. In fact, it appeared that a whole section of the speech had been outright plagiarised by the possible next first lady, or at least a member of her staff.

Despite claims from Mrs. Trump that she "wrote it with as little help as possible" in the run-up to the Convention, there are many who can't help thinking that this is the work of a disgruntled intern or staffer... Especially as many people believe that the text of the speech also contains an out-and-out prime example of that internet favourite, the Rickroll (**tinyurl.com/MMnet25v**), which certainly does seem to be the case (**tinyurl.com/MMnet25w**)

.AVWhy..?

Sometimes kids are cute and fun, sometimes they're a annoying as hell. Sometimes, they're both at the same time, as a couple of not-quite-newlyweds from Australia found out. The couple, now Tom and Katie Quirk, were right in the middle of reciting their vows as part of their waterfront wedding ceremony, when their niece Chloe decided that she'd had enough and decided to make a run for it. Wedding video gold ensued (**tinyurl.com/MMnet25x**) in the form of a lovely bit of background action that would probably make Wes Anderson smile...

QUICK BITS... Robot Wars is back. You knew that already, right?

Caption Competition

Two weeks ago, we left you with this puzzling image and asked you for captions. Here's a selection of the best:

- **doctoryorkie:** "Telesales – always hounding you."
- **doctoryorkie:** "Well-known Linux distro helpline."
- **JayCeeDee:** "Well, you never questioned the BatPhone!"
- **The VFM Addict:** "A bone, stupid. I said give the dog a bone."
- **BullStuff:** "We are out at the moment. Please leave a message after the bark."
- **gregb49:** "All this, just so that you can do the old dog and bone joke?"
- **johnbarry:** "Phone Guard"
- **ZX81:** Rover's ears are ringing."
- **EdP:** "For BT support you can understand - the new Cockney Help Point."
- **Sawboman:** "Dogged by debit? Let me paws your troubles."
- **ZEDSinBED:** ""Fido was always making a spectacle of himself."
- **Glenn Heaton:** "I see the dog but where is the bone?"
- **Frank Everett:** "At the third bark it will be 11:47 precisely."
- **Thomas Turnbull:** "I keep getting this ringing sound in my ears I must be barking mad."
- **Peter Hopkins:** "The MD of Churchill Insurance."

Thanks to everyone who entered, but this week's winner is doctoryorkie, with the short but sweet "Golden receiver."

If you have a caption for picture below, head to the 'Other Stuff' section of our forum (**forum.micromart.co.uk**), or email us via **editorial@micromart.co.uk**, remembering to add the issue number to the email subject line.

Goodbye VHS

Last ever recorder goes out the door

While consumers in the UK said a fond farewell to VHS technology over a decade ago, our friends in Japan have only just waved it off.

Funai Electric, which was still making VCRs until the end of July, has now produced its last recorder, according to reports. The company sold just 750,000 units last year, and it's reportedly finding it hard to find the parts needed to keep production ongoing.

We have to say that we're honestly a little surprised that this is only just happening now, but if this is officially the end of VHS, then can we just write that we felt a bit nostalgic about the old tapes.

We have fond memories of picking up limited and special edition VHS cassettes from retailers back in the day, long before the cloud began to dictate our viewing habits.

Sigh.

Photo App From Magix

All-in-one capture and edit tool

Software firm Magix has released the fourth iteration of its Camera MX app for Android.

Billed as an all-in-one solution for recording, optimisation and sharing photos and videos, the app is completely free, and this latest version brings Live Shots, letting users record moving images and then share them as animated clips while a completely redesigned interface promises a more user-friendly workflow.

The update features a host of real-time effects including over 20 filters and three effects packages such as HDR, Mirror, Distortion, Overlays and Textures. It also includes "extensive" optimisation options such as cropping, brightness, contrast, saturation and colour intensity.

You can download this update now from the Google Play store.

Snippets!

Facebook Messenger Reaches A Billion

Facebook says that its Messenger chat platform has a billion monthly users.

Announcing the figure in a blog post, Facebook also said that "our team is committed to building experiences you love and to making all the interactions in your life easier no matter who you are communicating with".

The billion figure is important for Facebook, proving to advertisers that the platform works and proving to customers that the Messenger service has strong, widespread appeal.

Steam Community Demand Fuels Game

Independent game studio Arrogant Pixel has released a new gameplay trailer for mobile and online point and click game *The Tale of Doris and The Dragon*.

The game has been submitted to the Steam Greenlight program and is making steady progress to be potentially picked up for a wider audience of PC users. Head for **steamcommunity.com** to look at information on the game, and others within the Steam Greenlight program.

BAFTA Young Stars Announced

The British Academy of Film and Television Arts has now announced the winners of its 2016 BAFTA Young Game Designers competition at a ceremony in the capital.

Among the winners were four game creators aged between 13 and 18, including Nic Gordon and his title, *YOU ARE BEING FOLLOWED*, a story-driven game containing puzzle and exploration elements with the gamer in control of a blind woman in pursuit of a place of complete silence.

The four big winners will receive a host of prizes, including further development of their game with industry experts. Nicely done, BAFTA.

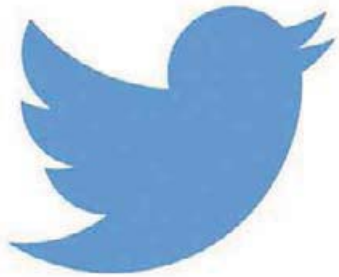
Twitter Opens Up Verification

Now anyone can have a blue badge. Well, not quite anyone

It used to be the case that only high-profile Twitter users – usually famous personalities and such – could apply for verified account status. Verified accounts have that blue badge on them, flagging up the real accounts from the fakes.

Now we can all prove that we are who we say we are as Twitter has opened up the application process for all users. You have to file an online application to have an account verified, and Twitter will verify an account if it is deemed to be of public interest. Examples would be organisations and people in areas such as government, politics, religion, journalism, media and business, and Twitter has made the call to make it easier for users to "find creators and influencers".

If you think you're a highly influential person of public interest, why not apply? You too could be rubbing shoulders with Taylor Swift. Or not.



Wearables Market Dipping?

Apple Watch sales fall

Research company IDC has reported on sales of smartwatches in the second quarter, and it's found that sales fell by 32% compared with the same period last year. This is the first time the market has dipped.

The company has also pointed out Apple Watch sales as having had the biggest impact, with Apple having shipped 1.6m smartwatches in the second quarter, a 55% drop compared with the previous year. Apple's wearables also accounted for just 47% of the smartwatch market, whereas it accounted for 72% of the market over the same period in the previous year.

Things should be looking up for Apple as the year goes on, however, with the release of the Apple Watch 2 expected to have a positive impact on sales. It's possible that its release could also help to drive the smartphone market in general, such is Apple's overall dominance.

QUICK BITS... A gamer in the US has already caught all the Pokemon in Pokemon Go. Dedication

Fastcut Update Offers New Templates

Tool for amateur filmmakers

Users of Magix's action-cam software, Fastcut, can download the package's latest update.

The update has brought eight new editing templates plus the option for users to create their own templates and add their own music. Whether using video cameras, action cams, smartphones or tablets, it's aimed at amateurs looking to create decent-looking videos from their core footage and share them quickly too.

With dynamic editing templates complete with fitting background music, Fastcut can automatically transform ordinary footage into a "perfectly edited, action-packed video" that matches the beat of the music, adopting an easy, straightforward workflow. The update has taken customer feedback into account, we're told, and if you're new to the software, you can pick it up for €50 (that's around £40) from **www.magix.com**.

Summer Bytes Festival Is Here

Head to Bletchley, good people

Back for another year, the month-long Summer Bytes Festival is taking over The National Museum of Computing.

Starting 30th July, the festival will run throughout August and the museum will be open every day from noon until 5pm. You can read at **www.tnmoc.org/bytes** all about the opportunities to interact with robots past and present, plus experience different realities – virtual, augmented, retro and real-time.

Virtual reality tech like Oculus Rift will be at visitors' disposal, while craze-of-the-moment Pokemon Go will be on site, because the museum is a Pokemon Gym. As for past robots, Tony Sale's famous humanoid creation George will converse with the modern-day robot Pepper. We wonder what they'll find to talk about?

If you're in the area, you really should pop in.

Mobile Banking Surpasses Desktop Logins

11 million app logins a day

Consumers much prefer banking via mobile banking apps than logging into desktop devices, according to data from the British Banking Association.

A report from the association has written that mobile banking app logins reached a giddy average of 11 million times a day in 2015, up from seven million a day in 2014. The report suggests that the reason behind this increase in the use of mobile apps lies in "the speed in which people can access their information and make transactions" with the use of fingerprint scanners helping in this respect.

Desktop daily logins actually fell marginally to 4.3 million as mobile apps have got better, and the banking market has also seen payments made by apps rise by 54% over 12 months to £347m.

Nintendo Talks Profits

Pokemon... no

With Pokemon Go on pretty much everybody's lips, you'd be forgiven for thinking that Nintendo would be laughing all the way to the bank, such has been the dramatic, widespread nature of its success.

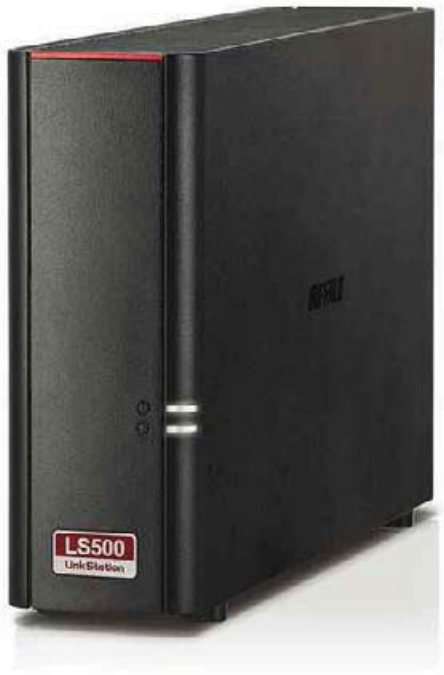
You would, however, be wrong. Nintendo has said that the success of the game will actually have a relatively small impact on the company's profit line, essentially picking up money from licensing and fees.

In fact, Nintendo's statement on the game's minimal impact on its financials saw its share price fall pretty dramatically. Don't shed too many tears, though. The company is actually doing pretty well for itself despite this recent dip.

Buffalo LinkStation 510 2TB

A single-bay NAS that's aimed for the home or office user

DETAILS
- **Price: ~£135**
- **Manufacturer: Buffalo**
- **Website: goo.gl/MR5DIr**
- **Requirements: Gigabit network for best results, any modern browser**



▲ *The Buffalo LinkStation 510 is a good single bay NAS*

▲ *It's slim enough to sit anywhere and is a breeze to use*

Buffalo's LinkStation range forms the backbone of the company's consumer NAS section. There are numerous models available together with various specifications and capacities, with each offering the ideal solution for the home or home office.

The LinkStation 510 is one of the newer models and is available in 2TB (which we're reviewing here), 3TB and 4TB capacities in a single disk format. Inside you'll find a Realtek RTD1195N dual-core 1GHz processor with 256MB of DDR3 memory and the aforementioned SATA 3Gb/s drive pre-installed.

Connectivity consists of a single USB 3.0 port and a gigabit Ethernet port, together with a power slider button, DC power in and a Function button – all of which are located at the rear of the device.

The Function button has several uses: it can be used to start copying content from a USB connected device to the LinkStation, it can be used to initialise any settings you've made and it can be used to restore the LinkStation back to its factory default settings.

The LinkStation itself measures 45 x 128 x 205mm and weighs just 1.3kg. It's constructed from a solid, black matte plastic with vented section to the top and bottom. There are a couple of activity LEDs to the front indicating power and function; the Function LED will flash when the device is copying via the USB port.

Overall it's well built and certainly tough enough to withstand the occasional knocks and bumps an office device may endure over its lifetime. It's also remarkably quiet and thanks to the slim proportions it'll easily integrate itself into most setups at home or in the office.

The setup process is easy enough through the combination of the downloadable NAS Navigator software and the web-based interface, a Linux-looking thing where you can gain access to the internal drive and download and install the various applications. Within a few minutes we were up and running and transferring content to the drive.

The performance of the LinkStation is certainly good enough, with a sustained write speed of around 62MB per second and a read speed of 71MB per second. Although this fall slightly short of the advertised 100MB-plus per second rate, it's still a decent performance indicator, and as we all know, the advertised speeds of these devices rarely coincide with the real-world values.

There's a good selection of applications available for the LinkStation 510. You've got the usual disk manager, image and video viewer, as well as Samba, FTP, AFP, iTunes and a Bit Torrent downloader. Suffice to say there's enough for most users' needs.

The Buffalo LinkStation 510 is a good single bay NAS device. It's quick, easy to set up and use and it'll keep the user happy for many years to come and it's also reasonably priced at around £135. **mm**

David Hayward

Easy to use and ideal for home and office users

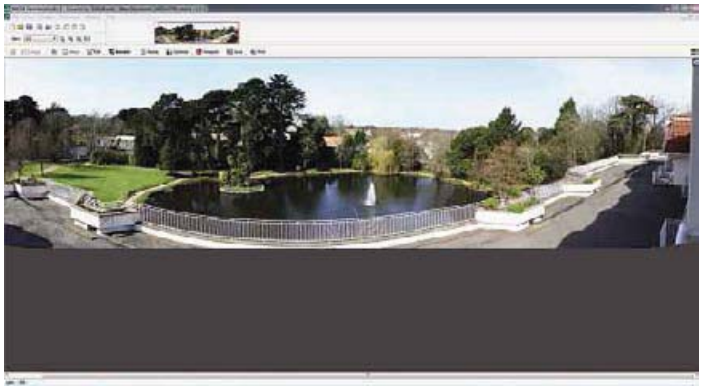
EDITOR'S CHOICE micro mart

Xara Designer Pro 365

The latest update to Xara's high end product, Designer Pro now with 365 updates

DETAILS
- **Price: £219, upgrade From X11, £75**
- **Manufacturer: Xara**
- **Website: www.xara.com**
- **Requirements: Windows XP or later, Intel Celeron or AMD Sempron processor or newer, 500MB RAM, 300MB disk space**

Cutting an object with the magnetic lasso



Very impressive panoramas

Xara Designer Pro is one of those invaluable products that once you use it, you'll wonder how you managed without it. It's the complete toolkit for designers, covering all areas of graphic design, encompassing page layout, illustration, photo editing, web design and just about everything in between. Unlike some of its competitors, it's a fully WYSIWYG application. This means you don't have to jump to a preview screen to see how it looks, because what you see in front of you is how it will print (or in the case of a website, how it will appear online). It also has one of the fastest vector rendering systems you'll ever find; the upshot of that is it's a more fluid environment to work in.

The company has just released a new version, introducing some new features and enhancing others. It's also added the 365 suffix, which means any new features or updates will be available to you for a full year as they're developed. Any maintenance updates will naturally continue after the 12-month period, but if you ever reinstall the program, it will revert back to the version you bought at the time of first registration.

Although quite an accomplished product already, the developer has managed to add a lot of new and updated features, to the point where it's hard to know where to start. So let's look at what I believe to be the most time saving of these: the new and improved SmartShapes. It's always been possible to round the corners of a square or rectangle, but now you can have different corners on the same object. So with fillet, concave and a square cutout, you can make your shapes more interesting. As before, the size of the corner is controlled by the grab handles that appear when you double-click an object. Other new SmartShapes include spiral, percentage rings and SmartCharts; that allow you to create quite complex charts with a few mouse clicks.

One of the other new utilities is the version 3 Panorama Studio found in the Photo Flyout. Rather than a menu option, this has now evolved into a separate application. I gave it a few different sets of images to work with, and it produced some outstanding stitched images quite quickly. However, I found it worked better if you've matched images taken with a level horizontal plane, ideally using a tripod. Of course, the new Photo/Straighten Scale feature can be used to overcome any horizon errors before you start. Simply drag a guide down from the ruler and rotate the image using the internal rotation arrow.

While we're on the subject of image editing, the new magnetic lasso tool is a welcome addition to the arsenal, which I have to say in my opinion works better that the Photoshop version. It follows the object you're trying to select more accurately; you can also stop and click again to force an even closer path.

While I'm not a great advocate of special effects in photographs, the latest Effects Painter has changed my mind somewhat. It allows you to selectively add a wide range of effects to an area, the clever part being that the level of the effect is determined by the settings of the brush you use. Like most of the editing operations, it's also non-destructive, so you can easily go back and change or remove something you don't like. However, if you're fond of these effects, this version now has a collection of 26 photo filter presets.

In this version, the content catalogue has been moved online and now includes free-to-use stock photos and vector art.

Incidentally, if you read my recent review of Xara's Web Designer 365, I thought it worth mentioning that Xara Designer Pro incorporates the whole of that product as well.

mm Joe Lavery

A worthwhile upgrade to what was already a fine product

micro mart
9 Quality
9 Value
9 Overall

Linksys EA9500 Max-Stream AC5400 MU-MIMO Gigabit Router

Mark reviews the product that takes wi-fi technology to a whole new level

DETAILS

- **Price: £317.99 (PC World)**
- **Manufacturer: Linksys**
- **Website: goo.gl/8TIXSz**
- **Requirements: Deep pockets, cable/fibre Internet, 802.11ac wi-fi clients**

Having just covered BT's new Smart Hub with seven antennas, it's easy to wonder if the new Linksys EA9500 is only marginally better with eight.

But that's like comparing a Colt 45 with the original Gatling Gun, because both of those had six barrels, but the amount of lead spewed by the latter was significantly greater.

Where BT managed on the Smart Hub an impressive AC2200 rating with 3x3 MIMO on 2.4GHz and 4x4 MIMO on 5GHz, the EA9500 is AC5400 spec, with tri-band operations (80GHz) and a quad-stream capability.

That last feature really confused me when this kit arrived from Linksys, because it insisted on bundling it with four of its AC600 USB adapters. I thought it had made a mistake putting four in, until I was told that I should speed test this platform with four devices simultaneously slamming the wireless network.

To share around its wireless clients, it has 1,000Mbps or 2.4GHz connectivity and two complete channels of 5GHz that add up to 2.166Mbps on each side and a total bandwidth reservoir of 5,333 megabits.

The only caveat to that incredible bandwidth potential (666Mbps) is that at this time no single client has the technology to exploit it all or even a quarter of it. Clients are reduced to ganging up on the EA9500, because otherwise it sits there idly with buckets of bandwidth unused.

But having the most amazing wi-fi available isn't the whole story here, because to handle the MU-MIMO (Multi-User Multiple Input Multiple Output) model, it needs plenty of internal backbone, so that one user's activities doesn't impact another.

Linksys put enough backbone and processing power in the EA9500 that there's no choke point here, and the company gave it an eight-port gigabit LAN switch for good measure. I've seen four and even five LAN ports, but eight on a router is a new experience for me.

Along with the eight is a ninth WAN port designed for either a cable modem to use or for those with a separate ADSL2+/VDSL modem to connect to. That Linksys didn't put a modem in the ES9500 is mildly irritating, but given all the regional differences it's forced to deal with, it's quite understandable.

As routers go, the EA9500 has one of the most impressive web interfaces I've

seen so far, will all manner of useful interactions.

Linksys also built this hardware to work with its latest Max-Stream Range Extenders, so devices seamlessly switch service without ever appearing to disconnect.

This is also the first router I've seen with its own special smartphone app that can administer the router and even alert you if the router's internet connection is down. Linksys has done this by creating a cloud-based service that monitors the availability of your EA9500 and warns you if it isn't available.

If this equipment has a weakness, it's how utterly enormous it is. With all antennas attached, it's roughly 32cm across and 27cm deep, and it looks like a giant spider from Mars. It weighs 1.2kg, There's no wall mounting option, but at least you'll never be asked where you keep your router ever again.

> **"The very best wi-fi you can get, where money is no object"**

On the flipside of that, you've got a system that can take whatever you throw at it, and which provides stellar performance in both close quarters and at range.

If someone asks you what's the very best wi-fi you can get, where money is no object, then the answer is unreservedly this kit. However, for most home users and even small businesses, this is overkill on a Gettysburg level.

Unless you've got a massive house with numerous guests and they all stream HD movies to their devices continually, then you won't really need this level of firepower. The best technology costs plenty, but that's really not surprising considering everything that Linksys included in the EA9500.

mm Mark Pickavance

Features

- 1.4 GHz High-performance dual-core CPU.
- Tri-band design with the most powerful 4x4 AC wi-fi radios capable of delivering up to eight simultaneous MU-MIMO streams.
- Eight adjustable antennas for wide, omnidirectional coverage in very large single or multi-story homes.
- Eight gigabit Ethernet ports.
- Linksys smart wi-fi: Access and control your home network from anywhere using a web browser or mobile device (a setup, manage and troubleshooting solution).
- Concurrent tri-band wireless operation (1000 + 2166.67 + 2166.67Mbps).
- High-power wi-fi amplifiers.
- Advanced beamforming technology.
- Data transfer rates of up to 1000Mbps on 2.4GHz (four spatial streams with 1024-QAM).
- Data transfer rates of up to 2166.67 Mbps on 5GHz (four spatial streams with 1024-QAM).
- Integrated DHCP server with dynamic and static IP address assignment.
- PPTP, IPSec and L2TP pass-through.
- USB 2.0 and USB 3.0 ports.
- Storage features for external USB hard disk and flash drives (supports FAT, FAT32, NTFS and HFS+).
- UPnP IGD and media server.
- Supports DLNA for home.

Ultra-quick, amazingly powerful, unbelievably huge and super expensive

Auslogics BoostSpeed 9

Improve the performance of you PC with this latest product from Auslogics

DETAILS
- **Price: $59.95**
- **Manufacturer: Auslogics**
- **Website: www.auslogics.com**
- **Requirements: Windows XP or later, 60MB disk space, 512MB RAM**

If you're an experienced computer user, the chances are that you'll carry out some sort of system maintenance on a regular basis. However, the vast majority of users know nothing about the importance of keeping their systems clear of temporary files that can bring a PC to its knees, not to mention the removal of personal logins and surfing activity. Yet there are products that can help with this sort of essential maintenance, a case in point being this latest release from Auslogics.

BoostSpeed 9 is an update to the version I reviewed last year, which it's worth mentioning has been responsible for keeping my machine running like a Swiss watch ever since. So I'm interested to see what has been added to the application in this release. As before, the program is incredibly small for such a comprehensive product, because it covers all the essential areas that help to keep your computer running efficiently.

Basically, after installation, the program makes an initial diagnosis of your system, highlighting the areas that need attention. It will even do this before you've paid for it, so you can check out its recommendations before you part with your money. This initial diagnostics includes checks for junk files, system stability and much more. Unless your machine is comparatively new, the report will undoubtedly shock you with thousands of problems that need attention. Luckily, these can be fixed with a single click of the mouse, which is the major benefit of the application, it just gets on with the job and reports when it's finished. In the unlikely event that it does something that adversely affects your system, you can simply go to the rescue centre menu and undo any changes that were made.

The Windows 10 Tweaker

Boost speed after the first diagnostics

While there are a number of improvements to the system in terms of extra tools and performance enhancements, the most useful new addition for Windows 10 users is the Windows 10 Tweaker. This allows you to customise the new OS to suit your needs. For example, it will remove the lock screen, which is designed more for touchscreen systems and is not very convenient if you don't have one. It will also get rid of those retail demos that you probably didn't want anyway, freeing up some more of your drive space. There are a number of other security areas that you can take back control of. For example, BoostSpeed's Ad Control prohibits applications from using your ad identifier to push targeted ads. You also have the option of disabling the built-in search engine Cortana, which collects and stores your personal information. If you want to preserve the performance of your system, it also allows you to disable the transfer of updates and syncing of data to your other Windows 10 devices. This can be more important than you think, because these background tasks can take quite a toll on your system resources.

I can certainly recommend this BoostSpeed 9 update for those who have migrated to Windows 10 and obviously for any new users. But I'm not sure there's enough there to justify an upgrade from version 8 for existing Windows 7 or 8 users.

mm Joe Lavery

Easy to use and makes Windows 10 a lot more customisable

Speedlink Ultor

Small footprint, big gaming

DETAILS
- Price: ~£80
- Manufacturer: Speedlink
- Website: goo.gl/Kzql0D
- Requirements: Available USB port, Windows XPor later for software

The Speedlink Ultor is a cracking compact gaming keyboard

If it was a little cheaper, it would be utterly amazing

Compact gaming keyboards are often overshadowed by their bigger counterparts, so many manufacturers don't want to waste resources by packing them with the features gamers want. However, that could all change with the launch of Speedlink's Ultor.

The Ultor is a tiny 78-key keyboard has some interesting features housed in its 350 x 122 x 33mm frame. For one, it's a mechanical keyboard using Red Kailh switches with a low actuation force and light weight design. It's also fully illuminated, with blue LEDs that can be dimmed according to your preference via the keyboard software or via the FN and Scroll Lock key. Incidentally, the WASD and arrow keys feature white LEDs to help them stand out against the blue LED colouring of the rest of the keyboard.

Furthermore (and because this is a gaming keyboard), there are five profiles available, with six macro keys, swappable WASD and arrow keys and a Windows key deactivation. There's even 64KB of internal memory to store the various profiles and an incredibly low response time of just 1ms as well as 1,000Hz polling.

> **"The keyboard feels sturdy and capable of taking the abuse of angry gamers"**

The design is simple enough, with raised keys and a small, read metallic frame. The keys are reasonably spaced, allowing bigger hands and fingers to glide over them without too much difficulty or mistyping, and there's a 1.7 metre braided USB cable to finish off the ensemble. Overall, the quality is good, and the keyboard feels sturdy and capable of taking the abuse of angry gamers.

The software will allow you to further customise the Ultor, allowing key bindings, profiles, saves, loads and so on. The Macro Manager section of the software is easy to use and lets you assign the six macro keys (Insert, Home, Page Up, Delete, End and Page Down). The Advanced section of the software lets you change the polling rate from 125Hz through to 1,000Hz, turn off the Windows key, alter the key response time, and change the light intensity of the key LEDs.

In use, the Ultor works well. The keys are responsive, with a key double-press reaction and a decent layout. The size of the keyboard wasn't something we'd normally opt for, because we prefer a full-sized keyboard with number pad, but we can easily see the benefits a compact keyboard has. In all honesty, we didn't even consider the lack of a number pad after a few hours of use, and we soon got used to it.

There's a lot on offer from the Speedlink Ultor, and it's one of the best compact keyboards we've tested in a long time. The £80 price does feel a little steep, but we're willing to forgive the cost somewhat, considering what you get. **mm David Hayward**

Well-designed, compact and very capable

Asus PL-AC56 AV2 1200 Wi-fi Powerline Adapter Kit

Asus solves the wi-fi blackspot in a stylish manner

DETAILS
- **Price: £159.99**
- **Manufacturer: Asus**
- **Website: goo.gl/zSDkCP**
- **Requirements: Broadband router with Ethernet connection, mains wiring**

Getting a strong wi-fi signal throughout your entire home can be challenging, the Queen shared with me recently. And this can even be true in less palatial properties, depending on how they're constructed.

The answer for some time has been to use either wired or in this case Powerline networking to extend the network to the problem area and then offer an alternative wi-fi access point there.

That's exactly what the Asus PL-AC56 Wi-fi Extender offers, and jolly nice looking it is, along with having a decent specification on paper.

In the box are the two elements: a Powerline adapter (PL-E56P) designed to connect to your access point using an included Ethernet cable, and the wi-fi Extender (PL-AC56) that's placed in the remote location. Network connectivity is via the electrical wiring and will work as long as both sites are on the same ring main.

The extender offers 802.11ac class wi-fi with dual band and dual antenna operations, and three Ethernet ports, and the Powerline is rated to 1200Mbps, appropriately.

Because these devices encrypt using 128-bit AES at the pairing stage of installation, if you live in an apartment, then your Powerline network can't be hacked by your neighbours.

> **"Detachable antennas could be useful to enhance reception"**

For those interested in such details, the HPAV2 Powerline technology used in both bits is provided by Qualcomm's QCA7500 and the wi-fi in the PL-AC56 by the QCA9563 (2.4GHz) QCA9882(5GHz) chips.

That rang a bell, because I'd seen a very similar specification from Devolo for its PLC 1200+ product, as it uses exactly the same chips. And in testing, the results were unsurprisingly similar, especially in respect of the Powerline performance. However, there are some significant differences that are worth pointing out.

The Asus design only has through power on the powerline end, whereas the Devolo product has it on both adapters. That might seem a minor point, but there's a design issue on the Asus product that compounds the matter of power on the extender end of the equation.

It's the width of the PL-AC56 that's the problem, because at 8cm wide on some double sockets, it will interfere with the adjacent socket, and on others it can cover up both on/off switches.

I understand how this happened, because this kit was probably designed for the US, where power sockets are often stacked vertically and not horizontally as we do. If you don't have a through power socket, then that obscured second socket might well be needed.

That point aside, there are some things about this hardware I really liked. Having detachable antennas could be useful for those wanting to enhance reception.

It also has a neat 'Clone' button that automatically copies the wi-fi SSID and password from your existing router using WPS, speeding up installation considerably.

What I should also point out is that with this kit in place, you can add other items to your Powerline network utilising the infrastructure that these parts create.

Pricing is on par with the equivalent Devolo kit, though the Asus hardware does look that bit slicker on the outside.

mm **Mark Pickavance**

Classy looking but oversized powerline wi-fi extender

Asus USB-AC68 Wi-fi Adapter

Asus merges a decent wi-fi adapter with a Decepticon. Or was that an Autobot?

DETAILS
- **Price: £59.99**
- **Manufacturer: Asus**
- **Website: goo.gl/tDEur4**
- **Requirements: Windows 7 or later, Mac 10.7 or later, USB 3.0 port**

The person who designed this product has a passion for Japanese anime transforming robots, because little else could explain why the antennas on this device deploy like a cute toy, into digital bunny ears.

My only reservation about this design choice is that because of size, it isn't always practical to have this USB device coming out of the top, side or back of a computer. Thankfully, Asus spotted this potential problem and included an upright cradle with a 1m extension cable.

A bonus to that decision is that you get to place it where you can get the best reception, and the AC class wi-fi that is baked into this is all about getting the best out of wireless networking.

Installation could have been smoother, because Windows (7, 8.x or 10) doesn't have a default driver to install, forcing you to go off and search for one online. Once that's in place, though, this device works very smoothly, and in my tests significantly outperformed my built-in 102.11ac adapter on my Dell XPS 13 Ultrabook.

That speed, however, is entirely dependent on what you're connecting the USB-AC68 to, because the best performance requires either 802.11n TurboQAM on 2.4GHz or 802.11ac, with the latter promising 1300Mbps of theoretical bandwidth, even if that's a mostly theoretical level you'll never experience. Achieving half of that on a 5GHz connection, you've probably got optimal conditions, and those are 'bits' not 'bytes' so you're realistically looking at 85-90MB/s. That doesn't compare unreasonably with gigabit Ethernet, though that connectivity won't change speed as much depending on the location of the adapter and access point.

Asus recommends that you use its RT-AC68U router with the USB-AC68, though it will work with other AC routers as long as they support the 3x4 MIMO antenna configuration used in this device. If has four antennas, but only two are visible, while the others are in the main body of the USB-AC68.

If I have a problem with this design, it's that for it to work optimally it needs a USB 3.0 port. And a laptop with 802.11n wi-fi installed is unlikely to have a USB 3.0 port on it.

Desktop PC owners who want to use wi-fi will find this much more useful, because even if they don't have USB 3.0, with a spare PCIe slot they can easily add one.

The transforming aspect is very clever, though the person who designed it focused entirely on that and didn't notice that they failed to provide any integrated place to put the blade cap once it's removed.

If you have a desktop PC that you must connect via wi-fi, then this is a very effective solution as long as you've already invested in an 802.11ac router. However, you can get AC1200 USB adapters for half this price, even if they're much less interesting to look at.

mm Mark Pickavance

Specifications USB-AC68	
Processor	RTK 8814AU
Interface	USB 3.0
Antenna	2 x external antennas + 2 x internal antennas
Operating Frequency	2.4 GHz and 5 GHz
Data Rate	802.11b: up to 11Mbps 802.11a/g: up to 54Mbps 802.11n: up to 450Mbps TurboQAM(2.4GHz): up to 600Mbps 802.11ac: up to 1300Mbps
802.11ac Specification	MIMO: 2.4GHz 3T4R, 5GHz 3T4R Beamforming: standard-based and universal 20/40/80MHz bandwidth
Size	115 x 30 x 17.5mm
Weight	44g, with cradle 113.5g

A USB 802.11ac adapter that transforms

GROUP TEST

A3 Printers

Printing on A3 paper was once something only professional set ups were capable of doing, the realm of businesses willing to spend thousands on a printer that could support the larger paper format.

These days, however, you can pick up an A3 printer for under £100, which is quite incredible really.

We have six of them on test here, across a varied price range, to see which offer users the best from the A3 printing perspective

A3 Printers

HP Officejet 7110

DETAILS
- **Price: £115 (Ebuyer)**
- **Manufacturer: HP**
- **Website: goo.gl/3KtJBm**
- **Requirements: USB, Ethernet, wi-fi, genuine ink for best results**

The HP Officejet 7110 may lack the AIO treatment, but it's a good printer

It's reasonably priced too and the running costs are low

The Officejet 7110 was one of the first printers from HP to combine bigger-than-A4 printing with consumer-focused features. Before this model, there were examples in that format with one or two nods to home users, but nothing that managed to pack the lot into a neat package.

On paper this machine ticks a lot of boxes. It has a 500MHz processor, 16MB of ROM and 128MB of DDR3 memory to help process the larger print jobs. There's a single USB 2.0 port, 100Mb/s Ethernet port and 802.11n wi-fi too. It supports HP ePrint and Apple AirPrint and its colour print resolution can hit an impressive 4800 x 1200dpi. The input capacity is 250 sheets, with custom paper sizes from 76.2 x 127mm through to 330.2 x 482.6mm.

The design is as simplified as possible, with no LCD screen or any form of digital output and feedback. What you do get are a row of indicator LEDs along the left-hand side of the paper output tray, which signify the Ethernet connectivity, wi-fi, paper warnings, cancel and paper feed. Along the opposite side are LEDs representing the four ink cartridges and whether they're about to run dry.

There's not much else to draw your attention. The dark brown plastic chassis, with its rounded corners, is quite subtle and the ports are mounted in recessed areas to the rear of the printer too, so there are no eyesores spoiling the minimalistic look.

The print speeds are okay, with our five-page A4 text test emerging at around eight pages per minute (ppm), and colour A4 at a reasonable 4ppm. A full A3 colour page was printed in around four minutes, on glossy paper, which again isn't too bad.

The print quality in A4 was good, about the same as you'd expect from HP's A4 consumer models. It would certainly suit most user's needs. The A3 colour print, even on glossy paper, though, didn't really excite us. The definition was good, but the 7110 lacked the colour depth some of the other printers in this group achieved. If you just printed it out without anything else to compare it with, you'd probably be satisfied with what you got, but when placed next to a print from the Epson XP 960 you could clearly see the 7110 lacking.

As for replacement inks, a genuine four colour high capacity pack can be found for £42.43, offering 1,000 pages in black and 825 pages from the other colours. This equates to 1.2p per page. A compatible pack, offering the same number of pages, can be picked up for just £29.32 or 0.8p per page.

The HP Officejet 7110 is a good A3 sized printer with plenty of connectivity, but it's lacking some more refined features and the print quality isn't quite as good as we would expect. For around £115, though, it's fine for most small offices and homes where colour depth isn't going to matter.

Epson Photo XP-960

DETAILS
- **Price: £180 (Ebuyer)**
- **Manufacturer: Epson**
- **Website: goo.gl/8beORt**
- **Requirements: wi-fi, Ethernet, USB, genuine ink for best results**

The Epson XP-960 is an excellent quality A3 printer

There's plenty of technology and features available

Where the HP Officejet 7110 opted for an office-type look and feel, but with home user features, Epson has gone all-in with its Photo XP-960 and added everything but the kitchen sink. This surprisingly compact printer, manages to include a vast array of connectivity and features. Notably, it utilises the Epson Micro Piezo print head and Claria Photo HD Ink technologies, which when combined are said to deliver a higher print quality.

It has a print resolution of 5760 x 1440dpi, duplex, a tray for CD and DVD printing, a 4800 x 4800dpi scanner, 100Mb/s Ethernet port, 802.11n wi-fi, PictBridge USB and a memory card reader. There's also a 109mm LCD touchscreen, where you can configure and initialise all the printer's features.

It seems Epson has tried to think of everything when it came to designing the Photo XP-960, it even has a mechanical tray that extends when a print is being fed through and the section where the LCD screen is mounted rises to a comfortable viewing angle for easy access.

We said it was compact, with the 479 x 356 x 148mm dimensions feeling more like your average A4 home printer than a photo-quality A3 setup. The only thing we didn't like too much about the design was the fact that A3 paper needed to be fed in through the rear – where you could extend a stand to support the large paper format – and it involved sending the print through, then following the on-screen prompts to load the paper. This made continuous A3 printing nigh-on impossible, unless you have someone present at the printer throughout the entire job. A4 printing, though, was via the front trays and could handle up to 100 sheets.

The print quality, though, despite the odd A3 paper loading, was superb. The level of detail and the depth of the colours was excellent, on both A4 and A3 prints. Printing to glossy paper revealed more depth, as it should, and when the highest levels of quality were selected, the A3 image printed was by far the best we've seen from a non-commercial printer.

Print speeds were fairly average, however, with the black text A4 five-page test managing around 6ppm and the colour A4 at around 3.5ppm. The A3 colour glossy page print, at full quality setting was timed at three minutes, which is a little faster than that of the HP Officejet 7110.

In terms of supply costs, a genuine six-colour 'XL' cartridge set (offering 500 pages for the black and 740 pages for the remaining five colours) costs £69.09, equating to 1.6p per page. The standard level six-colour (240 pages black, 360 the rest) costs a more reasonable £43.73 or 2.1p per page. The compatible equivalent costs £21.85, though, offering the same page count as the standard genuine pack and coming to a more effective 1.1p per page.

Despite the A3 page loading setup, the Epson Photo XP-960 is an excellent large format printer. It has every technology you could ask for from a modern printer, the print quality is amazing and it's remarkably compact. It does, though, cost around £180, but we think it's worth the expense.

Canon Pixma iX6850

DETAILS
- Price: £150
- Manufacturer: Canon
- Website: goo.gl/vu931o
- Requirements: USB, Ethernet, wi-fi, genuine inks for best results

▲ *Sadly it lacks other features which make it a great all-rounder*

The Canon Pixma range caters for both home and business users, with the majority of home printers using the iP-naming convention and the iX-label for the business orientated models. Naturally, since this is an iX6850 it's designed primarily for business and SOHO users.

A compact unit that measures 584 x 310 x 159mm and a design that's not too far from the usual Canon reference models, the iX6850 does offer USB, 100Mb/s Ethernet and 802.11b/g/n wi-fi, as well as support for Apple AirPrint, the Canon Print App and Google cloud Print.

Print resolutions hit an exceptional 9600 x 2400 and there's room in the tray for 150 A4 sheets or 20 sheets of glossy photo paper. There's also support for A3+ paper sizes, a paper format that is a little larger than the standard A3 – 11.7" wide for standard A3 and 13" wide for A3+.

It is, however, a pretty minimalist printer. There's no LCD, scanning, auto-duplexer or even extra media ports. There are three buttons to the right of the printer's front panel for power, paper feed and wi-fi setup, with corresponding LEDs. Other than that, there's nothing else to indicate any problems, advanced setup away from the computer or otherwise.

Print quality was excellent, though. The text was crisp and easy to read and the colour images were sharp with a good degree of colour depth. Although sharp, the poster-sized A3 colour prints weren't quite as rich in colours as those printed from the Epson XP-960. The detail was superb and you could clearly see every individual blade of grass from a 4K image, it's just the colours were a little weak.

> **"The text was crisp and easy to read and the colour images were sharp"**

The print speeds were certainly quicker than we've seen so far, though. The five A4 pages of text came through at 10ppm, while the A4 colour photo print managed 6ppm. The A3 – we didn't use A3+ – glossy photo print at full resolution shot through at a blistering two minutes and forty seconds.

As for ink you can buy a genuine high capacity pack of four cartridges offering 1,130 pages on the black, 267 pages on the cyan, 313 pages on the magenta and 274 pages on the yellow – why they're rated so oddly we have no idea – for £42.74, which equates to 2.2p per page. A compatible high capacity pack with the same yield will cost just £15.97 and offer a better 0.6p per page. To confuse matters even more with regards to the Pixma inks, the compatible high capacity pack has a second black cartridge which has a yield of 500 pages.

The Canon Pixma iX6850 is a good A3 printer with a fantastic print resolution. However, we did find it lacked a lot of, not so much necessary, but handy features and costing around £150 there's a lot more that can be had from the extra £30 for the Epson XP-960.

Brother MFC-J6520DW

DETAILS
- Price: £230
- Manufacturer: Brother
- Website: goo.gl/dwskB2
- Requirements: USB, Ethernet, Wifi, genuine inks for best results

The Brother MFC-J6520DW was one of the first printers to incorporate A3 printing alongside home user functionality and technology that A4 printers had employed for many years. To add to that, the company also included everything that the SOHO worker would require, and probably a few extras too.

The J6520DW is a moderately large printer measuring 657 x 521 x 350mm and weighing around 15kg. It has a print resolution of 6000 x 1200dpi, a scanning resolution of up to 2400 x 2400dpi, a 33.6Kbps fax modem, 100Mb/s Ethernet, USB and 802.11n wi-fi. There's also a 6.8cm colour touchscreen with numeric control pad (for dialling a fax number, primarily), a 20-page ADF, a single sheet feeder to the rear and a section to the front-left of the printer that hides an SD card reader and PictBridge USB port.

The design is very business-like, though its white, black and grey colouring may feel a little old school to some. It works well enough, though. The front control panel with the LCD touchscreen swings out for a better viewing and use angle, but it doesn't feel quite as sturdy as the equivalent from the Epson printer we've looked at. Likewise, the paper feed trays and the ADF feel a bit too flimsy for constant office use. However, we're sure it'll last long enough in the SOHO environment.

The Brother MFC-J6520DW offers a huge range of features

The running costs are low too

The A4 print quality wasn't as good as we've seen already. The text was sharp enough, but nowhere near the quality of the Canon iX6850. Also, the colour photo prints lacked depth and the crisp lines that most of the other models on test produced. The A3 print we produced didn't have anywhere near the same level of quality as the previous models either. In fact we had to double check it wasn't printing in draft or eco mode.

The speeds were roughly equivalent to that of the HP Officejet 7110, with the five-page A4 text test at around 8ppm and the colour A4 photo print at around 4.5ppm. The A3 full resolution glossy print took slightly over four minutes to print, all of which are reasonable enough for a non-pro setup.

As for ink supplies, a genuine high capacity pack of four colours with a yield of 2,400 pages for the black and 1,200 pages for the remaining colours costs £58.94, which equates to 1p per page. A compatible pack with the same yield, but missing the black, costs £12.18 or 0.3p per page. Naturally, though, you'll need to include a single black of the same yield, which is priced at £6.77 with the same 0.3p per page costs. Why the black is separate from the compatible pack, we have no idea.

Although the printing costs are quite low for the Brother MFC-J6520DW and it's capable of copying, scanning and faxing, the printer quality just isn't up to the same standards as we've already seen. Plus, the MFC-J6520DW costs around £230, fifty pounds more expensive than the far more capable Epson XP-960.

HP Officejet 7510

DETAILS
- Price: £100
- Manufacturer: HP
- Website: goo.gl/gfu83B
- Requirements: USB, Ethernet, wi-fi, genuine inks for best results

The cheap and cheerful Officejet 7510 is a good printer

There's plenty to like and it's cost effective to run

Our second HP entry in this group is the Officejet 7510, a more capable big brother to the previously reviewed Officejet 7110 and one designed for the enthusiast home user and higher-end SOHO user. It has a good number of features that are missing from the Officejet 7110, such as printing to A3+ sizes, a 35-sheet Automatic Document Feeder (ADF), a scanner with a resolution of 1200 x 1200dpi, a 33.6Kb/s fax modem and a 6.7cm LCD touchscreen.

Connectivity consists of USB 2.0, PictBridge compatible USB, 100Mb/s Ethernet and 802.11n wi-fi – as well as the RJ-11 fax port. There's support for Apple AirPrint, HP ePrint and wireless direct printing via Android and iOS devices.

The design is radically different from the Officejet 7110, due to the extras that are incorporated. It's a rather big printer measuring 613 x 483 x 366mm and weighing slightly over 13kg, but it seems solid enough, even the paper tray and its extending, telescopic sections. Oddly, although it's an A3 printer with a scanner, there wasn't enough room on the scan bed to fit an A3 sheet.

The print quality was good, though, with the text page being crisp and easily readable. The colour photo print was good too, but it lacked the colour depth of the Epson XP-960 and the sharp resolution of the Canon iX6850 model.

Print speeds were closer to that of the Canon Pixma iX6850 than the Officejet 7110. The black text, A4 five page test came through at 10ppm, while the colour A4 photo tests was around 6ppm. The colour, full resolution, glossy A3 photo print (we didn't have any A3+ paper to test in this instance) was completed just shy of three minutes.

As for printing costs, a pack of genuine high capacity cartridges with a yield of 1,000 pages for the black and 825 pages for the remaining colours, is priced at £42.43 with a cost of 1.2p per page. The compatible high capacity ink pack, with the same yield as the genuine pack, is priced at £29.32 with a reasonable cost per page of 0.8p.

The HP Officejet 7510 fills the gaps between the Officejet 7110 nicely, offering a more rounded printing solution for the end user. Its quality isn't too bad and the print speeds are good too. There's also the added features such as an ADF and fax capabilities – although in all honesty, who uses faxes these days? The best element to the Officejet 7510, though, is the extraordinarily low asking price of £100.

While not the best A3 printer in the group, it's cheap and cheerful enough for the average user.

Ricoh Aficio SG 7100DN

DETAILS
- **Price: £620**
- **Manufacturer: Ricoh**
- **Website: goo.gl/caFmnG**
- **Requirements: Ethernet, USB, genuine Gel Inks for best results**

The Ricoh Aficio SG 7100DN is a true business workhorse

But it's ridiculously expensive for what's on offer

Ricoh's Aficio range of laser printers has proved in the past to be quite worthy of the personal, home user as well as the small office or small workgroup. They're generally competitively priced, offer a decent range of features and are, for the most part, a good workhorse in a busy environment.

The Ricoh Aficio SG7100DN is the mid-range of its A3 capable printers. It's a reasonably sized unit, measuring 529 x 509 x 212.5mm and weighing nearly 15kg. The standard 250-sheet input capacity is more than enough for most users, but the busy office can increase that to a maximum of 600-sheets.

It's a solid business-class printer and as such it can offer somewhat more than the other printers in the group, but at the same time, it's also quite limited with a lack of a scanner, wi-fi or any other media reading ports.

Connectivity consists of a USB 2.0 port and a 100Mb/s Ethernet, so at least it is a networkable printer. That does limit its position in the home or office to some degree, though. On the plus side, you do get Ricoh's GelJet technology (which is meant to offer a better than average print quality for less ink used), auto duplex, a first page out in eight seconds feature and banner printing for sizes up to 1295 x 330mm.

The print quality from the Ricoh SG 7100DN, despite the claims of the Geljet tech's capabilities, isn't anywhere near as good as some of the printers here. The text pages were reasonably crisp and could be easily read, but the colour photo print lacked depth and seemed quite washed out when compared to the likes of the Epson or HP models.

Print speeds were certainly good, though, Aside from the first page out in eight second feature, which by the way really did work, the five-page A4 text was clocked at around 14ppm and, surprisingly, so was the A4 colour photo test. The A4, full resolution and glossy photo page took a rapid one and a half minutes to print, which is the fastest we've seen out of the entire group.

A four-colour pack of genuine, standard capacity Gel Inks with a yield of 2,500 pages for the black and 2,200 pages for the other colours is priced at £71.40, which puts the printing costs at 0.8p per page. A compatible pack, though, has a yield of only 600 pages across all four colours but is priced at a slightly less £66.54, offering a higher running cost per page of 2.8p.

The Ricoh Aficio SG 7100DN may seem like an obvious choice for the business and high capacity user, but considering the rather poor print quality and lack of other features we think it's best to look at some of the other models on test. And to add that statement, the Ricoh is priced at an extraordinary £620, which is pretty expensive even for a business.

Epson Photo XP-960

We felt the Epson Photo XP-960 managed to combine all of the best qualities we've come to expect from a modern printer, while still offering superb printing at the larger A3 page format. What's more, it manages to do all this at a pretty reasonable cost to users.

HP Officejet 7110

Although the HP Officejet 7510 offers users a wider range of features and technology, as with the other AIO printers we've come to use, not all users want scanning, ADF or LCD touchscreens. Therefore, we feel the HP Officejet 7110 is best of the non-AIO A3 printers and it's remarkably well-priced too.

How We Tested

Each printer was tested with A4 text, A4 colour photo and a pair of A3 posters – one of a collection of collage magazine covers and the other as a 4K landscape. We used the genuine inks that came with the printers and connected them to the wired network to send the print jobs through.

	HP Officejet 7110	Epson Photo XP-960	Canon Pixma iX6850	Brother MFC-J6520DW	HP Officejet 7510	Ricoh Aficio SG 7100DN
Price	£115	£180	£150	£230	£90	£620
Print Resolution	4800 x 1200dpi	5760 x 1440dpi	9600 x 2400dpi	6000 x 1200dpi	4800 x 1200dpi	3600 x 1200dpi
A4 Text Speed	8ppm	6ppm	10ppm	8ppm	10ppm	14ppm
A4 Colour Speed	4ppm	3.5ppm	6ppm	4.5ppm	6ppm	14ppm
A3 Photo Speed	4 mins	3 mins	2:40 mins	4:15 mins	2:50 mins	1:30 mins
Genuine Ink Costs	1.2p per page	1.6p per page	2.2p per page	1p per page	1.2p per page	0.8p per page
Compatible Ink Costs	08.p per page	1.1p per page	0.6p per page	0.3p per page	0.8p per page	2.8p per page

Top 5 Tech For Camping

Good? This stuff is 'in tents' (sorry...)

1 Bluetooth Speaker

Annoying other people with your music isn't something we'd recommend, but if you've set up camp far enough away from others, then a good speaker would be a worthy addition to your camping arsenal. No longer do you have to sit in silence while you're waiting for your tinned food to heat up on your tiny gas stove. Now you can do it to the glorious sound of your favourite tunes.

A Bluetooth model would be best, so you can move about with it easily, but even better is a waterproof speaker, just in case you accidentally drop it in a puddle while you're going for a stroll.

2 Biolite CampStove

Why use an ordinary stove when you can get one that will charge your phone too? The Biolite range (**www.bioliteenergy.com**) has grown a lot in the past few years, but the company's wood-burning stoves are still its most famous products.

Probably not one for camping purists, but we like it

The CampStove can be used for cooking or just for heating, and when you're burning wood, you're also charging up the attached battery pack. At £125, it's not cheap, but if you're a regular camper, then it might just be worth it.

3 Rugged Tablet

When you're in the middle of nowhere, a mobile device that offers GPS could be a life saver. Your smartphone is one good option, but even better is a dedicated device – one that's built to withstand extreme conditions. That's a much better option than risking an iPad or something like that.

Simply search for 'rugged tablet' in any search engine, and you'll see there are plenty of options. They're generally pretty expensive, though, so you might be better off just relying on your wits and maybe a map.

4 Loads Of Battery Packs

If you are taking some technology with you on your trip to the great outdoors, then unless you're going glamping, you won't have an easy way to charge up your gadgets. For that reason, we'd suggest taking some power banks with you – enough to get you through your trip.

That said, we reckon most of them aren't built to withstand the British weather, so it would be a good idea to pack them somewhere where they'll stay nice and dry, or just keep them in your car until you need them.

5 Wind-up Torch

Having some form of instant light on hand is always a good idea when you're spending the night under the stars. With a wind-up torch, you can have just that, without having to worry about packing a bag full of AA batteries too.

You can pick these up pretty easily online and in high-street stores, and you'll also find some that come with radios (technically speaking, they're radios with torches, rather than torches with radios). With one of them, you listen to your favourite DJs as you stumble through the darkness to the bushes for a pee. **mm**

Can You Ever Truly Wipe A Hard Drive?

If you're concerned about protecting your data, you may want to find out what you need to do to remove it from a drive

We all want to be secure when we use our PCs, be it online or off. We cover so many news stories and include so many features surrounding security in the pages of *Micro Mart* Security that we hope all of our regular readers know it is no joking matter. Indeed, every other week seems to bring more viruses, hacks, and potential problems that pose a threat to our systems yet, while it's understandable to err on the side of caution, the day-to-day threat to a domestic network may not be quite as severe as some may think.

Attacks are still relatively rare, and most users are perfectly safe most of the time. The importance of maintaining good security can't be stressed enough, though. Running a system without any method of protection is negligent, frankly; don't risk it – and always use antivirus and malware protection. You'll thank yourself, should the worst happen.

A big worry for anybody that's suffered IT security issues is the loss or theft of data. The idea that someone could get hold of your private information is a huge worry. We're not just talking financial details but personal details about you, your family, or anything else that relates to them. No one wants to be spied upon, and nor do they want to worry whether their privacy has been compromised.

File Shredder

In terms of traditional security, antivirus, malware scanners, and firewalls all help here, and with the right setup and vigilance, you'll be safe enough. What about the data sat on your hard disk when you upgrade or buy a new PC, though? This is an area that too many overlook, and is possibly one of the biggest security issues in home computing.

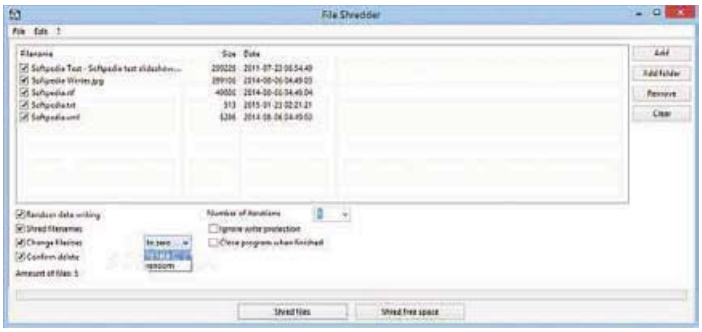
Disposable Culture

Today's approach to home technology is very different to a couple of decades ago. Whereas home tech was once a status symbol and a search for true, high-quality equipment was paramount, the old saying "they don't make them like they used to" rings so very true. Appliances and electronics used to be durable and long lasting. People still use stereo equipment from the 70s and 80s – and just take a look at the old Nokia 3310, and the many memes to show how well some older hardware could be built.

> **"Many people think destruction is the only real way to stop old data falling into the wrong hands"**

Today, though, the opposite seems true. We've all purchased products that die seemingly a day after the warranty ends, and there's a very disposable nature to certain products, especially mobile phones, which many upgrade on an almost yearly basis. Home computers also suffer from this upgrade and abandon culture, albeit through the more functional need to upgrade as technology actually does improve, and more storage is needed for the increased digital content we're so hungry for. This leads to a lot of hard disk upgrades and new USB drives. Old volumes are replaced by newer, larger, and faster units. Platter volumes give way to SSD, and those ever-useful USB drives grow increasingly larger in size.

What happens to all of the old drives, though? Where do they go? You'd be surprised to find out that a lot of them end up in the bin or at the local dump, and be even more surprised that a lot of people think nothing of this, and take no steps to ensure the data on them is protected or properly deleted.



Wipeout

The PC hard disk is one of the most replaced and upgraded components around, and the relative cheapness of larger capacity disks, and the falling price of SSD technology means people are always giving their systems more space or more speed. Old drives, however, often still contain data that could be retrieved by anyone with a passing knowledge of computing.

If no steps are taken to even delete the data, all someone needs to do is grab the drive, plug in into a PC and it's all there for them. Any trifling protection Windows may offer with account restrictions is easily bypassed with a bit of research.

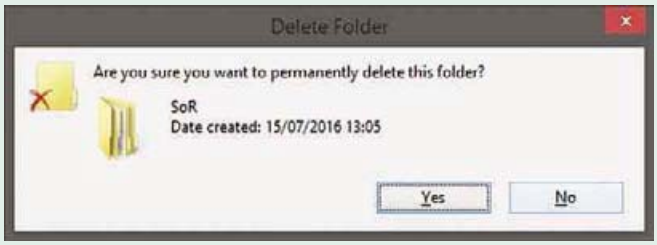
Even if the data is deleted, it's no barrier for anyone who really wants to snoop. When files are deleted in Windows, the data itself isn't actually removed. Only the file system references to the file are deleted. Data is only technically deleted when it's overwritten by something else, and even then, it can be retrieved by specialists.

This isn't anything new, and most people will be well aware of the fact data can be retrieved from hard disks and other media with the right know-how. This fear leads to a common belief that the only way to actually ensure your data is irretrievable is to physically damage the hardware. Whether it's smashing the drive to bits, burning it, scratching the platters, destroying the SSD chips, or even dropping it in the ocean, many people think destruction is the only real way to stop old data falling into the wrong hands. Is this true, though?

Simple Delete

Although far from forensically secure, there's a neat little trick that many don't realise exists when it comes to deleting files in Windows.

As you know, when you delete a file in Windows, the item gets sent to the Recycle Bin. Here it sits just in case you didn't mean to delete it, or may need it in future. However, if you're sure you won't need the file and want to delete it as well as Windows can, simply press Shift+Delete when you highlight the file or folder in question. This will prompt you to fully delete it, bypassing the Recycle Bin.



Bypass the Windows Recycle Bin with a simple button combo

Eraser

Secure Deletion

Destroying a hard drive may seem a little like overkill and, in many cases, it probably is in all honesty. There are plenty of other ways to protect your old data. The most accessible option being to use secure deletion tools or file shredders. These are special programs that are designed for one purpose, and that's to make sure data that's deleted stays deleted – so they're ideal when, say, you want to rid a drive of any trace of its previous owner.

Most tools of this type work in a very simple way in terms of general design. Usually, when you delete data, the references to it are removed, and that's all that happens, as we said before, but these programs take the next logical step and then overwrite the deleted data with junk information. The software doesn't just do this once, though, but several times. Overwriting the data time and again will eventually mean that the underlying original data becomes theoretically irretrievable.

This simple approach is very effective, and other programs go even further, adding encryption into the mix, further increasing the difficulty of ever getting the data back. Programs like this are not expensive either, and you can even get many free packages that do a very good job. Here are just a few.

File Shredder

www.fileshredder.org

The name says it all, really. Like a shredder secures your paper waste, File Shredder is a secure deletion tool that uses multiple binary writes to ensure your old data is as safe as possible. There are five different algorithms to choose from, in varying strengths, so you can pick the relevant level of security for the nature of your data. File Shredder also has a special algorithm that's designed to deal with unused disk space.

Alternate File Shredder

www.alternate-tools.com

This is a deceptively simple file shredding tool, but it offers some neat features. The actual shredding doesn't feature a selection of algorithms, instead using only one, but you do have the option to choose how many passes the program makes.

A great addition is the ability to also deal with file names as well as the data within them. Removing and shredding the name of the file as well as the contents adds more security, as the files – even if they're found by a retrieval tool – will be hard to identify. You can also utilise the quick access context menu command the program adds into Windows.

Moo0

Eraser

eraser.heidi.ie

Eraser has an effective deletion process that overwrites data, including previously deleted versions of existing items. There are many algorithms, including routines that employ two, three, and seven passes, including algorithms used by armed forces and the US Department of Defence. As well as the deletion tools, there's also a scheduler, so you can set up deletion runs, which is useful if you work with a lot of sensitive data, and need to make sure the system is cleaned up on a regular basis.

Moo0

www.moo0.com

This oddly titled shredder uses a very simple drag and drop interface that lets you drag and drop files or folders onto the application for secure deletion. It offers four different algorithms to pick from, and it'll show you what each option will do.

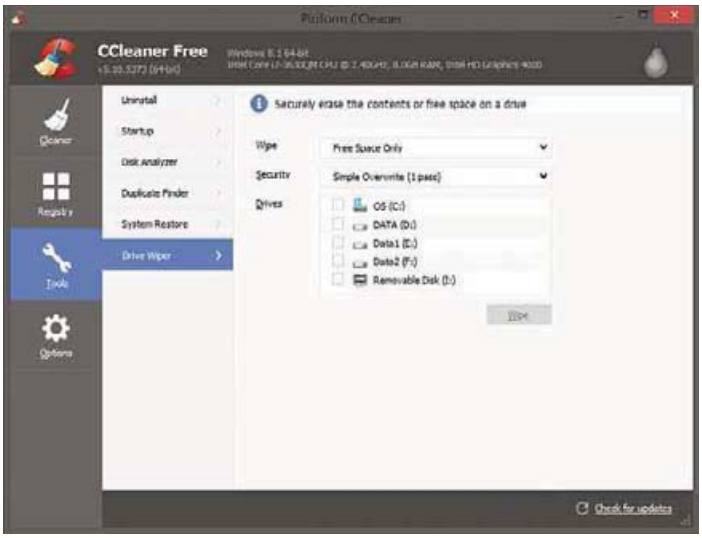
We like this option as files are securely deleted, and it's one of the easier, and more convenient tools to use with little getting in the way. The GUI is small and uncluttered, and using it requires very little effort.

Darik's Boot and Nuke

www.dban.org

Also called DBAN, this is another free tool that's very popular with users. It's designed for those who want to wipe entire

Darik's Boot and Nuke



Ccleaner comes with a built-in drive wiping tool

The shiny platters inside a hard disk store the data

If you take a PC to the local tip, never, ever leave the hard disk in the system. Always keep it, or dispose of it elsewhere

systems prior to selling them on or getting rid of old stock. It can be run from removable media, including floppy disks, and is able to wipe an entire system securely. It's effective, and very useful, although it does come with some limitations the developer makes clear.

For one, there's no guarantee of secure deletion on SSD volumes, there's no business-level auditing, as well as limited support for some hardware setups like RAID. Most of this won't trouble home users, however, except the SDD issue. Even with these limitations, it's still a very useful tool, and the ability to wipe a whole system on boot is great.

Stay Gone

These free options all achieve a great level of data security. However, alongside them there are many commercial options, for those who require – or feel more confident with – software with the kind of user support or licensing this brings with it. One of the most popular, and secure programs, is CyberScrub (**www.cyberscrub.com**), but a lot of security tools you may already be using come with file deletion modules, including some antivirus programs and system cleaners like Ccleaner (**www.piriform.com**), which features a Drive Wiper tool.

With these tools, you're fairly safe and sound, and most people who may get hold of the drive will have little luck in retrieving any data. Is there still a risk, though? Well, yes, probably. We've said many, many times that there's no such thing as flawless protection or impenetrable security, and it applies here too.

At one time, no one thought it was possible to retrieve a file simply deleted in the normal manner, but ways were found to do this. As more data deletion methods arrived, ways to counter them followed, which is why we find ourselves using military-grade shredding tools on our home computers in the first place. People will *always* find a way if the rewards are worth the effort.

So, to return to our earlier question, is physically destroying a drive the only cast-iron answer? Yes, pretty much. If you're concerned about an old drive getting into the wrong hands, and you want to totally make sure your data is safe then the destruction of the volume is a clear answer. You needn't destroy the old drive, however, just the platter(s) found inside. For SSD volumes, this is a little different, and it's probably easier to destroy the unit. Even big names in the industry would advise this, including security companies and research firms. It sounds extreme, but it's simply the best way if you absolutely need to keep old data out of other people's hands.

There's another simple option, though: simply keep the drive stored away. If you're going to give away or sell an old PC, just don't supply the drive with it and leave the new recipient to source and fit their own. If you want, you could just get a new, cheap drive yourself and fit – but if you don't, to avoid hassle, make sure to advertise the system as one that comes without any storage.

If you take an old PC to the local tip, never, ever leave the hard disk in the system. Always keep it, or at least dispose of it elsewhere. Anyone who's been to a tip will know that armies of people hang around looking for good finds, and PCs can often be just that, so be careful.

To sum up, there are many ways to securely delete data, most of which are perfectly fine for the home user. Using these software methods is really all you need to do. However, as data retrieval is very unlikely, but not impossible, taking a hammer to that old drive is still the best way if you're truly concerned. If that's the case, have at it and get rid of some stress. **mm**

Encryption

Although not an actual method of file deletion, encrypting a hard disk with specialised encryption software can be a superb method of keeping data safe. Encrypting a drive means the contents are locked out without the encryption key, so even if a drive is found intact, few could hope to get data off it.

Some commercially available encryption tools are so strong, even the police and military have been unable to decrypt data, and professional data retrieval companies have had to return drives to owners with a refund as they've been unable to crack it. So, if you need to secure your data, and fear theft, encryption is a sure-fire way to prevent any problems.

Alphabet Pi: V

David Briddock meanders through Raspberry Pi technology from A-to-Z

THIS WEEK: VNC, Vi and Video Core Graphics Processing

VNC

Depending on your Raspberry Pi project it's not always desirable to have it connected to a display, keyboard, and mouse. This is especially true for embedded projects, such as a Pi-powered robot. However, you can still interact with your Pi using Virtual Network Computing (VNC) software.

With VNC software you can establish a remote control connection between a PC and your Pi. This means you can use the PC's keyboard and mouse and see a real-time display of the Pi's command line or GUI desktop. Use a USB wi-fi dongle, or Pi 3, and the whole operation can be done wirelessly via your home wi-fi router.

Installation is a two stage process. First, install the VNC Server on the Raspberry Pi and enter a connection password when prompted. Next install the VNC Client on your Windows, Mac OS X or Linux computer.

You have a choice of VNC products for the Raspberry Pi. Some, like TightVNC (**tightvnc.com**), are open source and completely free. Others, like RealVNC (**goo.gl/pnzyOX**), have both free and licensed versions.

Vi

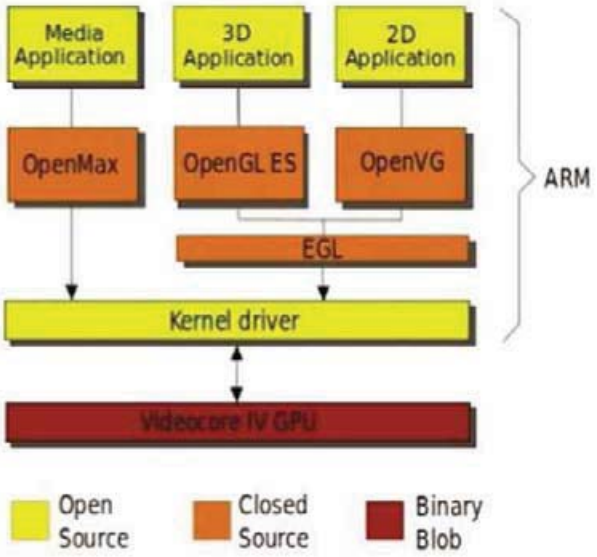
Vi is a classic text editor that's been around since the early days of Unix, which makes it around 40 years old. In those days it was appreciated as simpler alternative to the more flexible, but harder to learn, emacs editor.

Vi is also notable for having a 'modal' editing interface, though some users find switching between its command and insert mode rather frustrating. However, as Vi is pre-installed on every Linux operating system – so, once you've learned it foibles, you will always have an editor to hand.

An updated derivative called Vim (**vim.org**) exhibits all the classic Vi functionality, but also offers users a configurable user interface. Vim scripts can set syntax highlighting, colorisation and other IDE-like features.

If neither the Vi or Vim experience is to your liking, then Nano is another popular command-based text editor that's pre-installed on the Pi.

> **Vi is a classic text editor that's been around for 40 years since the early days of Unix**



▲ *Video software architecture*

Video Core Graphics Processing

The Raspberry Pi's Broadcom chip has a surprisingly powerful graphical processor (GPU). This high-performance/low-cost capability is down to a clever piece of hardware design.

Buried inside, and located alongside the main ARM processor, are two additional Video Core processors each capable of 24,000 million floating point operations per second. This multi-core architecture ensures that even the £4 Raspberry Pi Zero can handle full-blown graphical desktops and a wide range of 2D and 3D gaming apps.

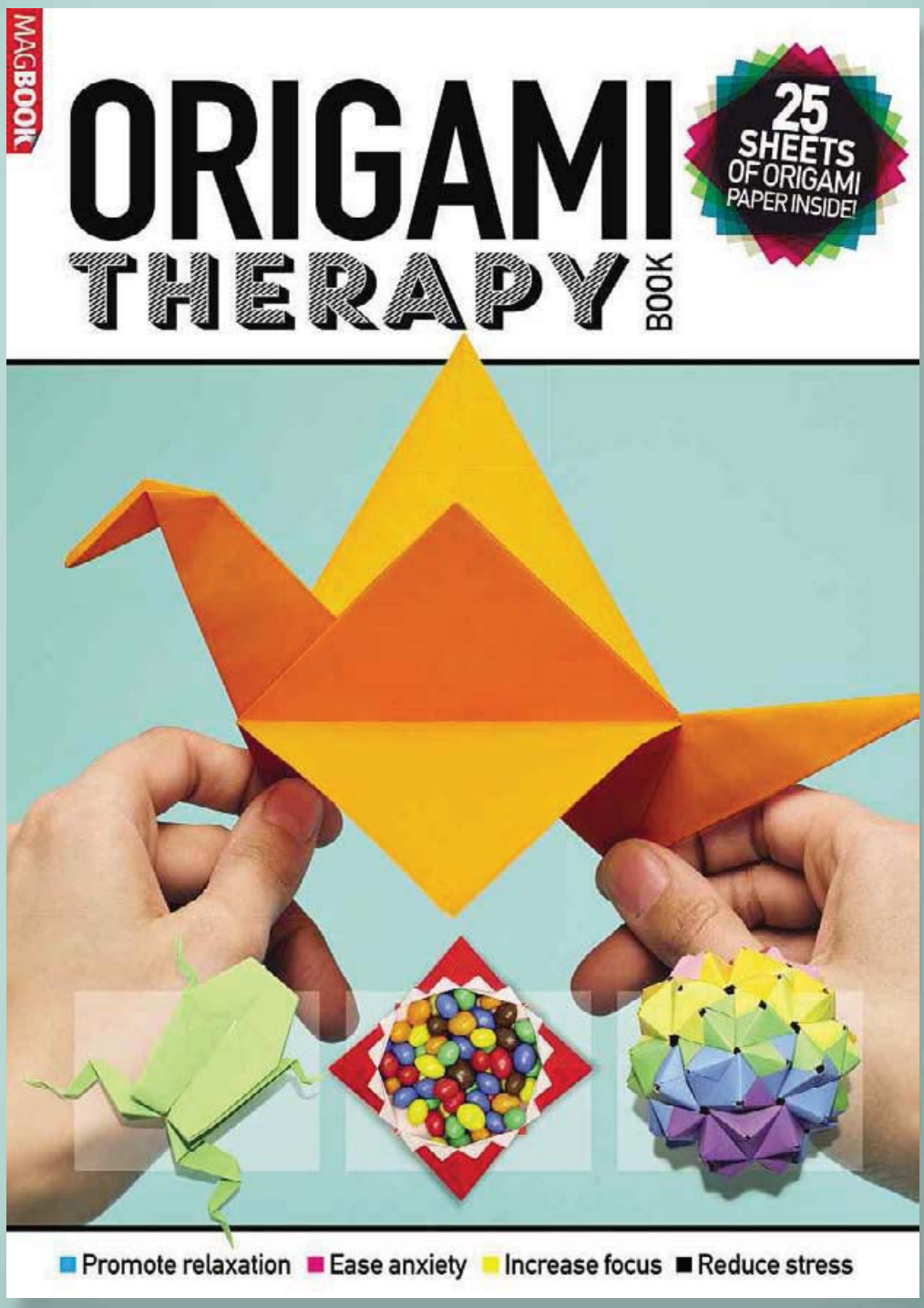
In addition, these video cores can hardware-decode many of today's popular video standards including H.264, MPEG 1, MPEG2, MPEG4, VC1, AVS, MJPG with resolutions of 1080 pixels at 30 frames per second. And it can software-accelerate VP6, VP7, VP8, RV, Theora and WMV9 at DVD resolutions.

What all that means in plain English is that any Raspberry Pi model is easily capable of streaming High Definition TV, DVD, and Blu-ray video. At present some of these encoders/decoders are constrained by licensing restrictions, others like VP8, MJPG and Theora are license-free.

The same video cores can also handle audio signal processing and mixing. This includes sending analog output to the board's built-in audio jack and processing audio-over-HDMI signals for TV and monitor connections. mm

Time to relax!

Forget your surroundings and gently unwind your body and mind



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Pick A Number

We look at how computers pick random numbers and whether they're really random at all

We're not sure when it happened, but at some point, the National Lottery added an option to its Instant Win online games to skip the actual game part and just see the result. Why? Because, as you can probably guess, there is nothing random about these games at all. Shock horror, right?

Well, no. The fact that these things are predetermined shouldn't come as a surprise, really, because if you think about it, even physical scratch cards are exactly the same: a card is either going to be a winner or it's not.

Oddly, this fact hasn't stopped some users suggesting some untoward is going on (**goo.gl/iW9B0**). It's not, of course. In fact, just like with real scratch cards, where the location of winning cards is already essentially set (because once they're in a location, that's where they stay), the randomness comes from us. The National Lottery operator, Camelot, doesn't determine who will go into a shop or onto the lottery website, and it can't decide who will buy a card or a game at any particular time.

Therefore, in that sense it is random, even if the game is predetermined. But even if such games don't need to use true randomness, it raises an interesting question: if an online game wanted to create a random result, how would it actually do it?

Pretty easily, you might think. After all, such games are based on software, and it's an everyday thing for us to request random results from computers. For example, when you put your music player in shuffle mode, it seems to play the tracks in a random order. You don't even think about it.

Additionally, millions of us play games of chance on computers, whether for fun or for money, and we assume that the results are

random. However, as we're about to explain, what we perceive as being random might actually be predetermined. And that all comes down to the fact at the most fundamental level, it's impossible for a computer to generate random numbers.

Cannot Compute

Although we've now got to the point where AI is fairly sophisticated and computers can beat the greatest chess players in the world, there are still a few things that humans do better than machines. For a start, we can understand love without our heads exploding (even though it might not feel like it sometimes), and we also possess a greater ability to learn and, of course, to feel.

Mixed up in all this is randomness. With potentially thousands or even millions of external variables acting on us at any one time, how we feel or think can be completely different from one day or even one minute to the next.

A computer, meanwhile, assuming it's functioning correctly, will follow sheer, unmitigated logic. Ask it a question, and you'll either get the same answer every time or one from a set of predetermined answers. Whether the sun is shining, whether it's night or day, it doesn't matter: the software does its job and that's it.

How then, can a computer generate a random number? The short answer is it can't. That might not seem a big deal, but think just how often we rely on computers to do this very thing. Everything they do is based, at the most fundamental level, on two numbers, zero and one, so whenever they're required to be random, whether it's to choose a random digit, letter or even an image, it will involve numbers. Ultimately, then, any kind of apparent randomness is created through the use of numbers. Whether it's dice throws, AI in a videogame or a lottery number picker, everything they do follows some sort of pattern of numbers.

A human, of course, can simply come up with a number. Whatever pops into our heads first can be the one we state when asked. But then again, it might not be, because we might change our minds at the last second and choose something else. That, most of us will agree, is fairly random.

Yet, as we've already stated, humans are affected by external stimuli. Our brains don't exist in isolation like computers, and everything around us affects our decisions (read the 'Is Life Really Random?' boxout for more on this). This use of outside forces is key to the creation of true randomness in computers as well, and we'll be explaining that shortly. First, though, let's look at what computers to do fake it.

Pseudo Randomness

As most of us already know, computers, in spite of their apparent 'intelligence', can only do what they're told to do by humans, using preset patterns. Such rigid logic is naturally not conducive to randomness, so programmers have to find ways to get around this. One particularly common method is to use a pseudo-random number generator (PRNG) which, as the name suggests, picks a number in a way that appears to be random, but without genuinely being so.

There are several different ways to create a PRNG, but what they share is that they use algorithms to produce sequences of numbers that appear to be random. These algorithms might be based simply on precalculated tables, or they might use some form of mathematical formulae, but the result is the same: a list of numbers, which the computer runs through as you make your requests.

Clearly, this is not truly random, but the good news is that PRNGs can be so effective that they appear random to humans and, for many purposes, they are perfectly sufficient. However, because they're based on mathematical logic, it's theoretically possible to use formulas to repeat a particular sequence or to spot patterns. All you need to know is the algorithm and the starting point (the seed number). This, as you can imagine, makes PRNGs less than ideal for applications such as electronic gambling or encryption.

> **"At the most fundamental level, it's impossible for a computer to generate random numbers"**

In the real world, when we shuffle a deck of cards, statistically speaking, a pack of cards will never have been in that particular order before. Indeed, the *QI* website states that the number of possible permutations looks like this: 80,658,175,170,943,878,571,660,636,856,403,766,975,289,505,440,883,277,824,000,000,000,000 (**qi.com/infocloud/playing-cards**).

Is Life Really Random?

If you believe in fate, then everything you do is predetermined. For some, that's a source of inspiration, but personally, we find this idea a bit depressing. Regardless, for the sake of argument, we'll say there's no such thing as fate – at least not in the romantic sense. Does that mean life is random?

On the face it, yes it is, because there are so many conditions and factors that can change at any moment, all interacting with and being influenced by each other. If you roll a die for example, not only is the result determined by the angle and speed at which you roll it, but also the weight of the die and the presence of changes in air pressure (i.e. a breeze). And if it's a hot day, the material of the die and the surface on which it lands might have expanded, further affecting the result. There are probably millions or even billions of variables, which gives us an obviously high degree of randomness.

Now imagine you could reproduce every single possible condition for the next roll and the next and the next after that. Would you get the same number each time? Possibly.

Similarly, a human brain could be seen as a biological computer with numerous external sensors, measuring electrical impulses (touch), changes in air pressure (sound) and radio waves (light), among other things. Without these or any other external sources of randomness, would a human pick the same number each time, if they could relive a particular moment? Could humans, like computers, be deterministic? Are we simply the product of a set of conditions, seemingly infinite as they may be?

These are questions of both philosophy and psychology, and you'll find plenty of views from these disciplines if you Google 'freewill and determinism'. And in more recent times, it's a question that's grown to encompass theories of quantum mechanics. As you can imagine, reading this stuff is a real minder bender, but it's never short of fascinating.

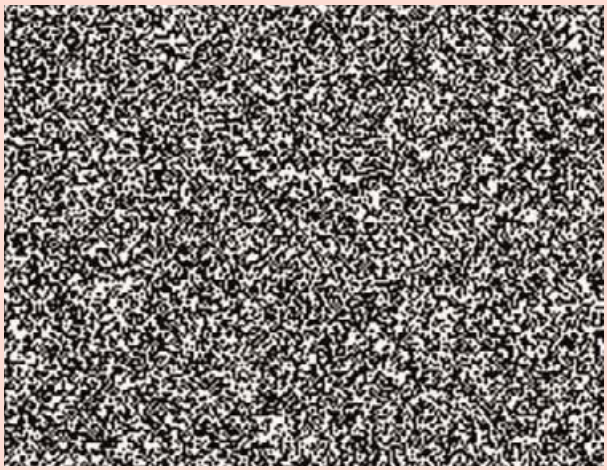
Here are some links to get you started:

- Stanford Encylopedia of Philosophy: **goo.gl/HkTQPf**
- Simply Psychology: **goo.gl/SlWHL3**
- Fact/Myth: **goo.gl/f7p0ch**

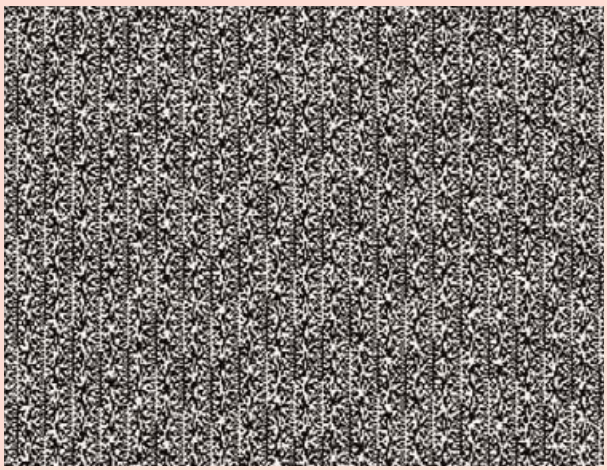
What Does Random Look Like?

As we all know, everything created by a computer is based on numbers, and that includes images. This means, if you want to, you can take randomly generated numbers and turn them into pictures. Using a random bitmap generator, such as the one at Random.org (**goo.gl/uBLUlz**), you can quickly see a visual representation of randomness.

As you can see from this example, it looks like someone spilt a pot of salt on a black table, with no discernible pattern. This is based on data from a TRNG.



Now compare that to this pseudo-random bitmap created by web dev Bo Allen (**boallen.com/random-numbers.html**), using the rand() PHP function with Windows Bitmap.



Quite clearly, a pattern is observable. Presented with just the numbers, a human would probably not be able to spot this, but when viewed in this way, the limitation of PRNGs is beautifully illustrated.

We have no idea how to pronounce this number, but it's probably safe to say that pseudo-random number generators don't even come close to producing this quantity of possible combinations.

In a gambling situation, if you had access to a poker site's algorithm and the seed number, you could theoretically use it to predict the next card, but in reality, you won't be able to. Seed numbers are closely guarded, as are the algorithms, and the number of permutations is likely to be immense, even if it doesn't match up to the reality of a genuine deck of cards shuffled by a human. Also, some sites might continue to generate numbers when games aren't being played, and it's only when a player enters a game that the algorithm is applied and a seed number chosen. So just like a person going into a shop and buying a scratch card, randomness can be provided by the timing of the human interaction.

For all intents and purposes, then, PRNGs are random enough to be used by gambling sites and, indeed, they are. You'll also find them in fruit machines and other software-based gambling devices.

And if you're thinking this is open to abuse from the companies behind gambling sites and machines, then you'd be right. If such firms wanted to rig the results created by their random number generators, they could, but thankfully most countries have strict regulations about how much chance players should have of winning (**goo.gl/hzOQHd**), and they're regularly audited to make sure they're complying with the law.

Introducing Entropy

As good as PRNGs are (and they're efficient too – hence their popularity among coders), they still don't create truly random numbers. In an encryption scenario, that translates into potential weakness. The strength of encryption relies largely on the creation of a strong key, so if it has been produced by a poorly coded PRNG, it could leave you vulnerable.

One solution to this problem is to introduce what's known as entropy. This refers to randomness that is 'collected' from an external source, which is then used to create an encryption key that is truly unique and non-reproducible – just like a human-shuffled deck of cards. In the case of mainstream encryption programs, such as the discontinued TrueCrypt, entropy could be created by the user moving the mouse around wherever they liked, but it was also introduced by the software tracking random changes in the operating system's API.

> **"If you had access to a poker site's algorithm and the seed number, you could theoretically use it to predict the next card"**

This still plugs into a pseudo-random number generator, but with a high level of entropy and complicated enough seed data, such encryption should be virtually impossible to crack. Indeed, assuming a PRNG is secure enough, with high enough level of entropy, it can be classed as a cryptographically secure pseudo-random number generator (CSPRNG). Such encryption is still not truly random, meaning it can theoretically be cracked, but the generation of numbers through pseudo-random methods can be enormously secure and, most importantly, it's efficient.

That's good news, because we all use encryption in one form or another every day, with one particularly popular use being in wi-fi protection.

However, we still haven't answered the question at the heart of this article: can a computer ever generate a truly random number? The answer is yes, but only with some help.

Truly Random

To generate a genuinely random number, a computer has to use a true random number generator (TRNG), which takes information garnered from physical phenomena and uses that randomness in its calculations. The movements of a mouse, for example, which can be used to add entropy to a PRNG, is an example of a physical source being used to create a random number.

However, it's only used to create a key, and the encryption program then relies on pseudo-random algorithms to do the rest of its work. If you wanted to create a program that could choose a continuous string of truly random numbers based on something in the real world, then moving a mouse every time wouldn't exactly be convenient, which you'd need to do if you wanted every number to truly random. Also, the level of entropy created by the movement of a mouse's laser over what is a relatively small physical space isn't as high as you might think.

Thankfully, though, there are other ways to add randomness, and they generally involve some kind of extra hardware, which is used to measure a physical phenomenon such as atmospheric noise. Such devices aren't generally employed by regular computer users, but there are hardware RNGs available to consumers, such as the OneRNG (**onerng.info**), a Kickstarter-funded, open-source entropy generator that plugs into a USB port. Gaining $48,551 NZD from 440 backers, the OneRNG uses two on-board sources of randomness: an avalanche diode that generates 'quantum noise' and a detuned RF receiver that "frequency hops at random times to random channels and returns the least significant bit from the (failed) demodulator -this returns significantly closer to 8 bits per byte of entropy data". This data can then be used to create unique, unpredictable encryption keys.

It's also possible to generate truly random numbers from a Raspberry Pi, using a circuit built into its SoC, which measures thermal noise. You read more about this at **goo.gl/ylzT8**.

If neither of these options appeals or if you want something more established, then you'll have to get in touch with specialist companies. For example, there's the Simtec Entropy Key (**www.entropykey.co.uk**). At the time of writing, however, the website was not functioning, so we're not sure if this is still available. We also found the TrueRNG (**goo.gl/wQa7Q8**) but only available from American websites. Indeed, according to the handy TRNG comparison chart at Wikipedia (**goo.gl/nGmx7b**), the only UK-based seller of this kind of hardware is Simtec. Your options, then, would be somewhat limited if you wanted to create truly random numbers at home.

But there is an answer, and it won't necessarily cost you a penny: an external service that generates truly random numbers for you and provides them on request. One excellent example of this is **www.random.org**. Using atmospheric noise to generate its numbers, Random.org provides a huge list of services, many of which are free, including simple dice rollers, lottery number pickers, password generators and list randomisers. It also offers an iOS and Android app, which offers a free coin flipper, but you can unlock more modes through in-app purchases to get access to a dice roller, a card shuffler, a lottery picker, an integer generator and a list randomiser.

There are plenty of other random number servers too, such as the Hotbits project (**www.fourmilab.ch/hotbits**), which tracks radioactive decay to create random numbers, and EntropyPool (**random.hd.org**). There are also pseudo-random services available, such as **andrew.hedges.name** and **randomnumbergenerator.com**.

Some Final Random Thoughts

If you're not in the market for a hardware RNG, a service like Random.org could be a workable solution. But it's worth considering this from Wikipedia: "Note: random numbers transferred over the public internet are not cryptographically secure for most purposes." Indeed, even Random.org org says the following:

"We should probably note that while fetching the numbers via secure HTTP would protect them from being observed while in transit, anyone genuinely concerned with security should not trust anyone else (including RANDOM.ORG) to generate their cryptographic keys."

Clearly, then, having your own hardware to generate numbers is preferable where security is of utmost importance. However, for most of us, regular encryption programs are more than sufficient, particularly if they're bolstered by something that introduces entropy. There's really no need to worry that you don't have a hardware RNG connected your PC.

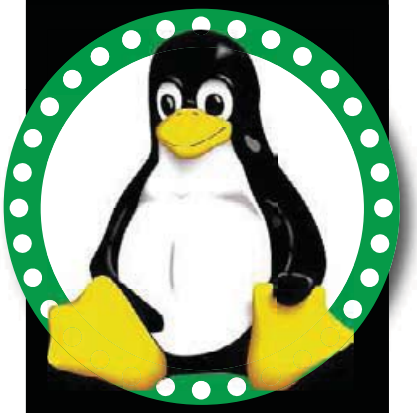
Anyway, if you think about it, even the data taken from a hardware RNG is the result of billions upon billions of external factors coalescing into one moment. Such thinking underpins chaos theory and the idea of the butterfly effect. Even the seemingly random mess that is real life could be seen as deterministic (although once you get to the quantum level, the whole can of worms that is quantum indeterminacy gets cracked open and we're back at square one – but that's a long, complicated story for another time).

All that matters is that there are far too many variables for a human or even a computer to say what will be next in a string of truly random numbers. To do so would mean being able to predict the future accurately. For proof of our inability to do that, just look at how much difficulty we humans have with creating accurate weather forecasts.

For us, it's ultimately just an intriguing notion to think that without some kind of external, natural source, if you ask a computer to come up with a random number, it can only really respond in one way: "How should I do that?" **mm**

Disclaimer

We aren't experts in encryption or mathematics, and this article is not intended to provide security advice. It was written purely for entertainment purposes and because we thought it was interesting.



They're Watching You

More anonymity for Linux

David Hayward has been using Linux since Red Hat 2.0 in schools, businesses and at home, which either makes him very knowledgeable or a glutton for extreme punishment

Since I had something of a conspiracy theorist moment last week, I thought it would be interesting to look at a few other anonymity focused distros.

A recent news item I read was that every Linux user is a potential target for government or other agency snooping. The article never went into great detail, but the emphasis was based on the fact that hiding your internet presence is a far easier thing to do with Linux than on any other operating system. Of course, you could claim that the powers-that-be aren't all that interested in us and that the fear of snooping is simply paranoia.

However, the fact of the matter is that everything we do is being filed, looked at and kept, presumably in case one of us ever decides to become a threat. So what can we do to make the lives of the NSA, FBI, CIA, MI6, Maj12 or whoever, a little more difficult? Use a super secure Linux distro to conduct our online transactions, that's what.

Super Secure Distros

Here are several of my personal favourite mega secure distros, which can be booted into a live environment and which offer a level of security not found in normal operating systems:

Tails

Tails is a live environment that's designed to help you use the internet anonymously. Now on version 2.4, Tails relies on the blessings of the Tor network in order to preserve your anonymity when online. This will protect you against traffic analysers and network surveillance, and it prevents sites from locating your physical location. For more info and the .iso, visit **goo.gl/CG0vG**.

Blackbuntu

Blacbuntu is slightly different, as it's a distro that is designed for the security and penetration testing professional, as opposed to being just a standard distro with the security bolted on.

Needless to say, there are many tools, programs and documentation bundled with Blackbuntu, which will not only help you to be more secure, but will also give you the opportunity to further test the security of your own network.

It's an interesting distro and well worth a look. Just head to **goo.gl/H8d8X** and follow the instructions.

Kali

Kali is a Debian-based distro that is quite possibly one of the most secure operating systems ever developed – in the modern internet age, that is.

There are over 300 penetration testing programs available, there's an ARM version, and it's a rolling distro. Naturally, since it's now a rolling distro, the testing tools are being continually updated.

You can get the latest .iso and even versions designed for VirtualBox and VMWare from **goo.gl/22WA2X**.

There you have it: three of the best secure Linux distros available. Of course, there are many more, what with Linux being the versatile OS that it is, but I'll leave you to locate them and report back via the letter page as to whether they're any good or not.

In the end, though, you're not going to be 100% anonymous unless you create a series of false identities, change IP addresses every ten minutes and use some kind of semi-offline OS. But at least using one of these will go some way to offering you the freedom to surf without the all-seeing eyes of the New World Order watching over you.

Kali Linux, one of the most secure operating systems available

Why Is The Music So Important?

Sven Harvey looks at the Amiga's aural impact

You will have noticed that the musical side of the Amiga gets mentioned an awful lot on this page – and it's with good reason.

There are a huge amount of remixes of Amiga music kicking around, not least of which is on AmigaRemix.com... but even then they're often just uprated versions of the 'instruments' used in the original music module.

There are many audio CDs of Amiga game music remixes too – but again very often they are simply more recreations and re-recordings rather than remixes per se.

Why is that? Perhaps it's because they don't need all that much work done to be considered for playlists in the 21st century, because it could do so well originally.

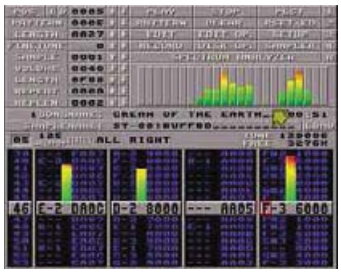
When speaking to people about making music on computers, it's often suggested that the Amiga was the first machine that enabled its users to make 'proper' music and, indeed, the first home computer where the music in the games (and perhaps scene demos) seemed 'real'. This isn't awfully correct, because thanks to the wonders of the SID chip, the C64 was capable of some serious audio feats... but it was never an easy thing to do. Thanks to the music programs made available for the Amiga, it's pretty easy to see that it was certainly the Amiga and its software that made making 'decent' computer based music accessible to so many people.

Deluxe Music Construction Set from Electronic Arts (1986) and Aegis Sonix (1985 on Amiga) may have been the thin end of the wedge, which Ultimate Soundtracker (a lesser known commercial application that came with an ST01 sample disk in 1987) enhanced, but it was the public domain and shareware utilities (that started off as Ultimate Soundtracker clones) that allowed the users to make music modules.

The trackers developed from Ultimate Soundtracker into Noisetracker (1989 freeware), but it was perhaps the much more stable ProTracker (1990 shareware) that really grabbed attention (and Protracker 2.3b got cover mounted on the Amiga mags cementing its place). One of ProTracker's main advantage was splitting the keyboard up like a music keyboard and thus being able to play the samples directly (which could also be edited in-program) and record what you were playing.

ST-01 was a selection of samples, primarily, for ProTracker, and those samples are potentially recognisable now as they turned up in underground club and dance hits for years following as experimental music artists started using the Amiga for their compositions. 'A Certain Kind of Persuasion' (**goo.gl/625Tvb**) was a piece of music created by Mike Clarke and Tim Wright for the 30th anniversary of the Amiga, last year, using just the samples from ST-01... and it was fantastic.

Not bad considering that at the time the ST was supposed to be the music machine thanks to those built-in MIDI ports!



Lincolnshire Amiga Group 10th Anniversary Event

October marks the tenth anniversary of LAG or Lincs. Amiga Group's foundation, and to celebrate it's holding a get together at its usual haunt, but all sorts of retro enthusiasts are invited. The show will take place on Saturday 1st October at the Welton Village Hall, Ryland Road, Welton-By, Lincoln LN2 3LU.

Tables are available (contact LAG for information) so you can sell your old kit if you wish, and there will be a raffle, with prizes including an AmigaPi system and an A500. Various machines will be on display and the normal attendance entry cost will be £4 including wi-fi.

For more information contact Lincs. Amiga Group via its website at **www.lincsamiga.org.uk**.

Sven Harvey has been our Amiga specialist for over 16 years, drawing on his 25 years retailing computer and video games and even longer writing about them

Yamaha DX Heaven

Ian McGurren plays Yamaha's sound of the 1980s on his tablet of the 2010s

Ian McGurren is a professional IT analyst, a semi-professional writer and a pretty amateur electronic musician. He likes gadgetry and loves making gadgets do things they were never designed to do

You've heard the sound of frequency modulation (or FM) synthesis, but unless you're a synth head or pro audio buff, you might not realise it. But if there's a sound all over the records of the 1980s, it's FM, often emanating from its most famous synth, Yamaha's DX7. Unlike the warm, woolly sound of the analogue synths of the 1970s, FM was sharp, bright and brash – perfect for the fashionable discotheques of the 1980s. From the lush electric piano of the likes of Whitney Houston, to the sharp funk bass of Michael Jackson's *Thriller* and *Bad* albums, it's a sound that changed music, and now that sound has come to iOS, and it's totally free.

FM Essential is not actually the first FM synth on iOS; there have been several, with some really good examples, like DXi and FM4, but this is the first from Yamaha, and therefore the first with the full heritage. That means a lot, with a ton of classic preset sounds included in the app.

The app follows on the AN2015 / Synth Book app released last year and follows a similar kind of layout, breaking down complex sound generation with easier-to-program controls. With AN2015, the synthesis method – subtractive – is relatively simple to grasp, starting with a bright sound and, with filters and amplitude generators, subtracting frequencies to get a final sound.

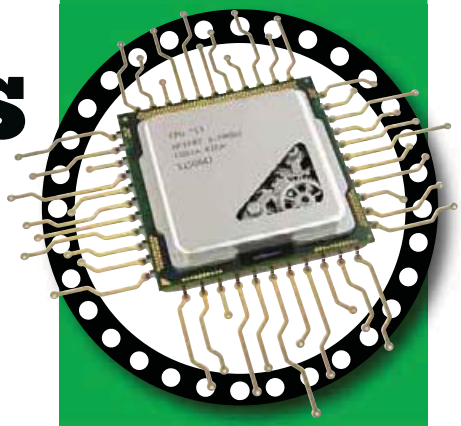
FM, however, is widely regarded as an unfriendly form of making sounds, using multiplication of sine waves together to create harmonics – it's why many FM synth owners rarely got into programming their hardware. FM Essential tries to take AN2015's approach to subtractive synthesis and apply it to FM, and with pretty good success. It's still reasonably impenetrable unless you're a mathematics whizz, but having a ton of parameters at your control on a touchpad gives you a degree of feeling that you're in control.

There are also the additional performance aspects, such as scale and chord sets, so set a scale, and you'll see the built-in keyboard discard all notes not in the scale, allowing easy playing without fear of hitting a bum note. The chord sets are just as much fun – set a key and you'll get a selection of chords and inversions you can play with a single finger – a superb tool for building up nice sequences. It's this instant gratification that brings the sometimes sterile FM sound alive more than anything, and it's great fun. There's even an arpeggiator and selection of drum patterns to play along with, though if you don't like house, electro or hip hop, then tough cheese, because you can't program your own.

It's not all great news; there is a catch. Ostensibly, FM Essential has been released to promote Yamaha's up and coming MX BU line of synths; it works in combination with the synths as a kind of add-on voice controllable it. But that ton of classic legacy FM sounds in the app are only unlocked with the synth, otherwise it's only a paltry 10 available. Hopefully, after a while Yamaha will see fit to open them up to all.

Yes, you'll find that FM is still quite harsh, but FM Essential does a great job of making an oft-derided form of synthesis attractive again, and just at the right time with the plastic sound of the 80s ever more present in modern music. Even if you don't fancy digging into frequency modulation synthesis, it's still a really good app just to play with and find inspiration from, and for the princely sum of free, you really can't complain. FM Essential is available now on the App Store.

Dash Bad Drivers With A Dashcam



Andrew Unsworth considers the need for a dashcam to record his daily commute

Travelling into work by train every day was hell. The annual season ticket took a huge chunk out of my salary every month, the service was poor, and I got more bruises each week than I did when I practised martial arts.

Now that I drive to work, I feel a lot better. No matter how bad it is on the road, it beats commuting by rail. The only trouble is that I now notice just how many nutters and terrible drivers use the roads and motorways.

Of course, not all drivers who crash or collide with other drivers are bad drivers. A lapse of concentration, mechanical failure or an exceptional event, such as a deer running into the road in front of you, can cause the best driver to run into trouble. The fact is that no matter how safe a driver you are, you're still subject to the laws of chance and the behaviour of other road users.

At one time, you'd have to give a statement in the event of a crash or an insurance claim and hope that your word is accepted. Now, however, you can invest in a dashboard video camera to provide supporting evidence of an event. Use of dashboard cameras (or dashcams, as they're also known) is increasing, and anyone who views the various news websites will have seen YouTube clips of dashcam footage that show extreme stupidity or miraculous escapes. Best of all, dashcams start from very reasonable prices.

The Transcend DrivePro 200 (**tinyurl.com/j4c44hn**), for example, is available for just £79.99 from Halfords (**www.halfords.com**) and Argos (**www.argos.co.uk**), and just £69.99 from Currys (**www.currys.co.uk**). For this, you get a Full HD video camera in compact housing, a 2.4" screen for viewing playback, a collision detection feature and a wide angle lens, among other things.

Transcend also produces the DrivePro 520, which has one forward-facing camera and one rear-facing camera. This means that passengers in the cockpit of the car can be videoed in addition to the road ahead. The DrivePro 520 also has built-in GPS to record data that can be used to map your journey and record the position of an accident. The DrivePro 520 is £160 at Halfords (**tinyurl.com/jeut3d7**).

Garmin, a company well versed in in-car tech such as GPS navigation systems, also produces dashcams such as the Dash Cam 35 HD (£129, **www.currys.co.uk**). The Dash Cam 35 HD can record video in Full HD, has built-in GPS to record location data and can tell you if you're driving too closely to the car in front of you.

There are, of course, many other dashboard cameras available from many other brands, certainly too many to mention here.

While it's possible to use a regular camcorder to capture video, it would be unwieldy, and it would be too difficult to mount such a thing safely, if at all. A regular camcorder would also be more expensive. An actioncam would be a better option, but dashcams have driving-specific features that actioncams don't have. One such feature is the collision detection or emergency sensor, which detects sudden changes in motion and enables recording protection for your video files, so they don't get overwritten or destroyed. Dash cams also have mounts that are designed for windscreens and car interiors, and the best models start automatically when you start the car and turn off when you cut the ignition.

Considering the range of brands and models available, the prices and the features available, now is probably the best time to invest in a dashcam. I think I'll be getting one in the next few weeks.

Andrew Unsworth has been writing about technology for several years, he's handy with a spanner and his handshaking skills are second to none

Ryan Lambie has loved videogames since he first stared up in awe at a *Galaxian* arcade cabinet in his local chip shop. 28 years on, Ryan writes about gaming for Micro Mart. He's still addicted to chips and still useless at *Galaxian*

Super Sonic?

There are no fewer than two Sonic games on the horizon, from an untitled 3D game with giant robots to the retro, 2D stylings of Sonic Mania

This week, Ryan takes a look at two new Sonic The Hedgehog games due out next year, and checks out the PC version of Gears Of War 4...

Plug & Play

Sonic The Hedgehog celebrates its 25th anniversary this year, meaning the fleet-footed mammal has managed to survive as a myriad other cute platforming mascots have faded into obscurity. So, how can Sonic last another 25 years, though? How can he stay relevant in an ever-changing medium? If your answer is 'he should be made to save the world from a fiery apocalypse featuring what appear to be giant robots, in order to win cookies', give yourself a clap – because that's exactly what *Project Sonic 2017* (working title) appears to be demanding of him.

Now, Sonic's been on a bit of a downward loop ever since the release of the frankly hideous *Sonic Boom* in 2014 – a game so bad even Sega seems to want us to forget about it. *Project Sonic*'s first trailer (**youtu.be/gCh9--2xcKk**) confidently announces that the franchise is back in the hands of Sonic Team, the studio that's worked on most of the best series entries, including the underrated *Sonic Colors*, which was a Wii exclusive for some reason.

While the trailer doesn't give too much – away other than its metropolitan, doom-laden setting – we're predicting a mix of 3D and 2.5D platform action will make up what appears to be a sequel, of sorts, to 2011's *Sonic Generations*. Like that game, *Project Sonic* features both incarnations of the eponymous hero – the cute, stoutly-proportioned one and the newer, longer-limbed version. If those appearances turn into reality, and it does turn out to be a sequel, that won't necessarily be a bad thing, with *Generations* being one of the better-received of the recent 3D Sonic efforts.

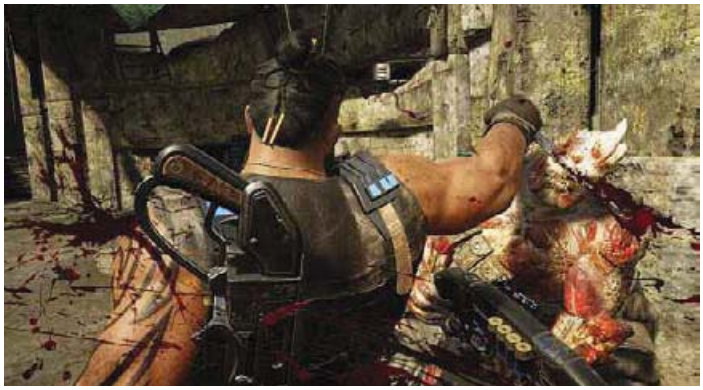
What might wind up getting long-time Sonic fans more enthusiastic is *Sonic Mania* (**youtu.be/KxmtYdEWVzo**), a 2D platformer that takes Sonic right back to his 16-bit roots; there's pixel art, an electronic soundtrack and the kind of frenzied bursts of running and ring collecting so many of us remember from the Mega Drive era. Sega describes *Sonic Mania* as a return to the Blue Blur's roots, which sounds like a great plan to us – though we're treating the game with a hint of caution, since *Sonic The Hedgehog 4* promised much the same thing yet the jumping mechanics felt completely wrong.

That Sonic Mania is a remix of the levels we saw in the first two or three *Sonic* games gives us hope that this may be the platformer we've been waiting for. There are new obstacles and gizmos – including what appears to be big tombola that spins Sonic around as though he's in a washing machine – plus Sonic's old friends Tails and Knuckles as playable characters.

Both *Sonic Mania* and *Project Sonic 2017* are due next year. We're hoping at least one of them gives Sonic the return to form he deserves.

Online

It isn't just *Sonic The Hedgehog* that has to prove it's still got what it takes to survive in a modern gaming landscape. The *Gears Of War* series may be half *Sonic*'s age, but 2013's entry, *Judgment*, suggested that it's already starting to run out of ideas. *Gears Of War 4*, meanwhile, is the first game in the series to be made by a team other than Epic – it's now in the hands of The Coalition, which has been working away on the sequel since at least 2014. So, can it bring a bit of innovation to the franchise rapidly approaching its tenth anniversary?



Many were lukewarm about Gears Of War 4's beta build, but The Coalition says the final version will be much improved, with numerous extras for PC users

Somewhat alarmingly, the response to the *Gears Of War 4* beta, which launched in May, suggested that the latest third-person shooter was business as usual; the meaty, chunky weapons and close-quarters shooting action panning out as broadly the same. Indeed, one of the few major additions to the multiplayer action worthy of note appears to be the ability to grab another player while they're hunkered down for cover.

More recently, The Coalition has come forward with the claim that May's beta was of a relatively early build of the game, and that the finished version will actually be quite different. "Though called a 'Beta', the *Gears 4* Beta was at an early pre-Alpha stage of the project," the studio wrote on its website; "a time where many of the final assets, animations, textures, audio and even gameplay elements are not in the game."

The studio has also added a list of features and tweaks that we'll see in the finished game – a list so long that we can't begin to reproduce it here, with many of the points concerning the fine-tuning the weaponry. There are reportedly visual improvements on the way, too, from more convincing shadows to more realistic textures.

The Coalition seems to be making a real effort to win over PC users, too, with the list of improvements for Windows set to include full keyboard and mouse support, 4K-quality textures, dynamic resolution support and a generous helping of video settings.

"Today we sit at 28 different settings and we're thinking of ways to add more for people to really have full control," the studio's Mike Rayner told Eurogamer. "Along with more settings, we're putting extra time into making it clear what impact a setting will have on GPU/CPU/VRAM so there is a clear correlation between a setting change and its performance impact."

As recognisable as the *Gears Of War* name is, the number of great shooters available for PC means that this year's sequel has some serious competition lined up against it. However, if The Coalition really is making the effort to tailor the game for Windows users, it may have a fighting chance of capturing our imaginations all over again when it launches in October.

Incoming

A venerable franchise that is more cerebral than *Sonic The Hedgehog* and *Gears Of War* put together, *Deus Ex* is back for another slab of futuristic action this August. Developer Eidos Montreal plans to double down on the open-ended, multi-path approach to the game, with the cyberpunk story adapting depending on whether we play stealthily or all-guns-blazing.

Talking to Gamespot, Eidos reveals that the game will take around 20 or 30 hours to complete – and that's assuming we ignore side quests and don't hang about to admire the view. A "New Game Plus" mode will also give us a chance to go back through and seek out all those bits we missed the first time.

Deus Ex: Mankind Divided will see the light of day on the 23rd August. **mm**

The Augments are back in Deus Ex: Mankind Divided, a sequel to the superb Human Revolution. It launches worldwide on the 23rd August

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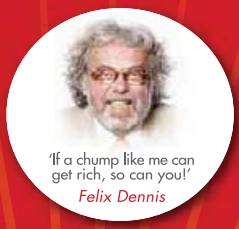

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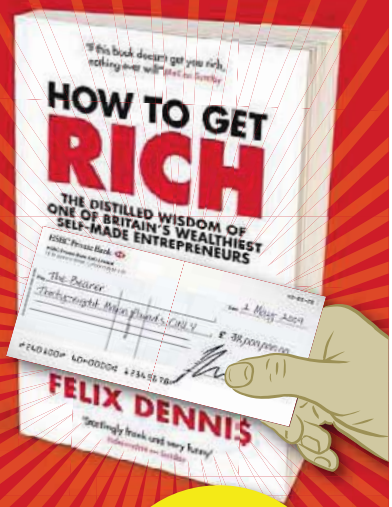

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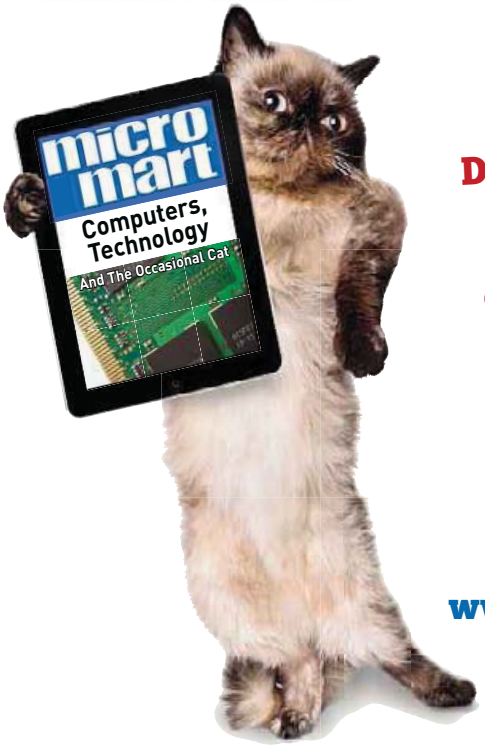

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E-mail: scobieg09@gmail.com

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SOFTWARE WANTED

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Tel: Wilf James (01767) 699809

Wanted: PictureToExe software, for making picture shows.
Tel: (01202) 610602
Email: ivor.mary@talktalk.net

Wanted: Quicken 2001. I desperately require a copy of QUICKEN 2001, UK Edition. I need to reinstall the program but have lost my original installation CD.
Email: david.maddams@icloud.com

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ASK AARON

Meet Aaron Birch. He's here to help you with any general upgrading, software and system building problems. He's got advice aplenty and you're very much welcome to it!

Send your questions to:
Aaron Birch
Micro Mart
Dennis Publishing
30 Cleveland Street
London
W1T 4JD

Contact Aaron by email at:
aaron@micromart.co.uk

Please try to keep your queries brief and limit them to just one question per letter, simply so we can squeeze in as many as we can each week. Please include relevant technical information too.

Aaron

No Room

When I was attempting to back up some files from a mobile device to my main PC I was told that there was no room on my hard drive. When I go to explorer, I can see that there's no room left, but when I highlight the files on the drive (which is just storage, no system files or OS), the file size isn't the same as the drive's capacity, so I should have space left.

Can you explain what may be going on here, and how I can solve the problem?

Dave

There could be different explanations for this, including Windows' creation of 'shadow copies' of files that can take up space. You may also have a page file set up on the drive that could be taking up space. There's also the possibility of hidden partitions for recovery.

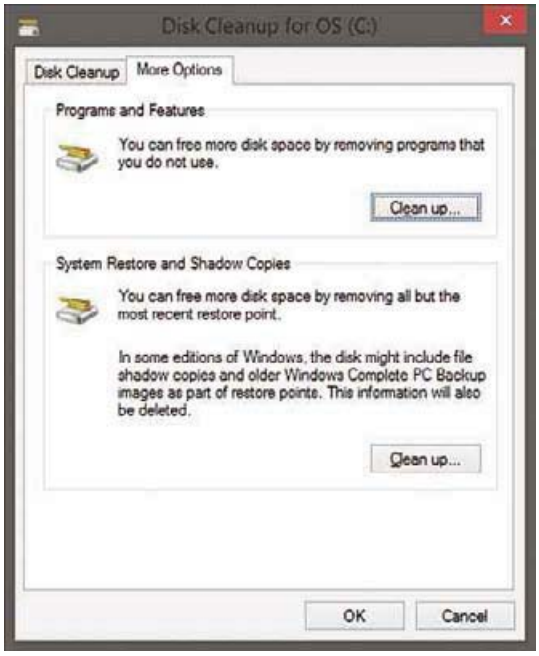
> **"Windows' creation of 'shadow copies' can take up space"**

A good place to start would be to run a system clean up. Do this by pressing WIN+R and typing 'cleanmgr' and pressing OK. Select the drive and start the scan. When the result appears (which could take time), click 'Clean up system files'. Another scan will be run, so wait for it to finish.

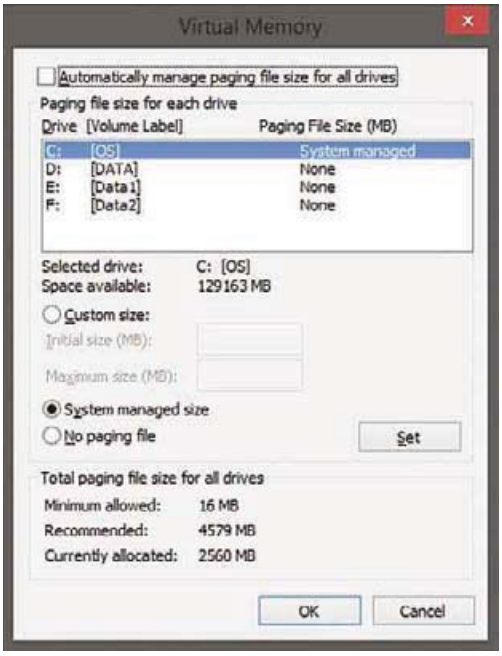
When the next dialog box appears, click the More Options tab and under the System Restore and Shadow Copies section, click Clean Up and then Delete. This will remove the shadow copies of files, as well System Restore points, so be sure you don't need any old restore points before you do this.

Once this is done, run the normal system cleanup too, just to be doubly sure, and you should find you'll have more space. I'd advise you create a new restore point as soon as possible, though, just in case you run into problems and need to restore your system.

To check if you have a page file taking up space on the drive, right-click Computer and select Advanced System Settings > Advanced > Settings (under Performance) > Advanced > Change. This will show you the page file window, where you can create and alter your page files. If everything is greyed out, un-tick the box at the top of the window. Now you'll be able to see which drives have page files and can make any changes you need.



Deleting Windows' shadow copies of files to save some disk space



You may not be aware which drive has a page file setup, and this could be taking up space

Can't Touch This!?!

I've got a new touchscreen laptop that's already giving me trouble. It's a Samsung model, and I've only had it for just over two weeks.

Initially, the device worked well, and I found the combination of laptop and touchsreen to be really useful, and it really was the best of both worlds. Things then turned sour when the touchscreen wouldn't work. It first happened when I was on a train, trying to do some work. The touchscreen simply didn't' respond, and I had to use the keyboard instead.

The next day I tried to use it again, and the touchscreen worked perfectly. I thought it was really strange, but as it was working, I dismissed it, until the next morning, when I came to use it and the touchscreen refused to work again.

I tried restarting the system and it didn't work. After several restarts, I found the touchscreen seemed to work intermittently, with no real pattern. I didn't make any changes. So, thinking it may be something to do with Windows or a driver issue, I used my recovery disc to restore the system to factory defaults. The same thing happened, with the screen working sometimes and not others.

I've contacted Samsung tech support, but they've not been very helpful and have asked me to pay for postage to return the system, with the possibility of a steep cost for exchange. I don't feel this is fair, as I've not done anything. They seem to think it's a software-based problem and thus my fault.

I've tried different drivers since then, as I'm not going to pay so much for something I've not done, but so far I just can't seem to fix the problem. Can you please help?

Tim

Based on your description of the problem and the results of the steps you've taken to investigate and fix the problem yourself I'm fairly certain the problem isn't software or driver-based at all. Usually, if an issue stems from drivers or some form of software conflict it won't be intermittent and will be a permanent problem that won't go away until the conflicting software has been removed, or otherwise altered.

The problem you're getting has remained in an intermittent state regardless of the state of the system and drivers. Even after a factory reset the touchscreen still manifested problems which, in my opinion, eliminates the software problem. Instead, I'm fairly certain your problem lies with a hardware fault, most likely a loose connection somewhere that's causing the touchscreen to respond erratically. This would clearly manifest after the laptop has been moved, but if the connection problem is sensitive enough, it could even be affected by the slightest touch of the device.

This being the case, the actual problem inside the laptop could be very easy to fix, and it could simply be a connector that's come loose and needs to be plugged back in firmly. Then again, the problem could be more serious and caused by actual physical damage or a manufacturing defect. The only way to find out for certain is to open the laptop up and check it out. This would void your warranty, of course, so I'd hold off on this.

First I'd contact the store or website where you purchased the laptop from, as you should have at least a 12-month warranty. This should get you a new laptop in exchange for no extra cost, save for any possible postage. If, for some reason you're not covered, which I doubt, you could look into fixing the problem yourself.

You didn't mention the actual model of the laptop, so I can't specify but, to find out how best to open the unit up, search for your model online and look for technical manuals, or even YouTube videos. You'll probably be able to find some instruction that'll help.

Once the case is open, look for wires connecting the screen to the motherboard. There's good chance these may be loose, and you could fix the problem easily. Good luck!

Some laptop problems, even touchscreen, can be easy to fix, just don't void your warranty

ASK JASON

Meet Jason D'Allison, a veteran of Micro Mart's panel of experts. He's here to help with any technical questions, including anything to do with tablets or smartphones, as well as PCs

Send your questions to:
Jason D'Allison
Micro Mart
Dennis Publishing
30 Cleveland Street
London
W1T 4JD

Contact Jason by email at:
jason@micromart.co.uk

While we try to cover as many questions as we can, we regret that Jason cannot answer your questions personally, but he'll cover as many as he possibly can each week. Please ask one question per letter and remember to include the full specification of your computer, including its operating system.

Jason

Self Or Shelf?

I'm in need of a new PC, and I was going to build my own. Looking on **www.ebuyer.com**, though, there are pre-built machines, mostly from Zoostorm, that seem absurdly cheap (especially as I don't need an OS). Is there any cost advantage to self-building a PC any more?

Joel, Wiltshire

It's always worth revisiting this question from time to time. As I write, the cheapest Zoostorm at www.ebuyer.com costs £129.99 and has the following specs:

- ***CPU:*** *Celeron 1037U (dual-core, 1.8GHz).*
- ***Motherboard:*** *NM70-based.*
- ***RAM:*** *1 × 4GB DDR3-1333.*
- ***GPU:*** *HD Graphics (6 EUs).*
- ***HDD:*** *500GB SATA.*
- ***ODD:*** *DVD rewriter.*
- ***OS:*** *none.*

By my reckoning, Joel, self-building a similar setup from the same site costs £168.90. In round numbers, that's a nasty £39 premium, or 30%. However, the Zoostorm's CPU is a laptop job, soldered to a motherboard not available on the open market. Instead, then, I've opted for a Celeron G3900 (dual-core, 2.8GHz) and a Biostar H110MHV3 – pretty much the cheapest combination I could see. The advantages over the Zoostorm system are a substantial speed boost (Skylake too, not Ivy Bridge), USB 3.0 (not just USB 2.0), HDMI and D-sub/VGA (not just DVI and D-sub/VGA), PCIe 3.x (not just PCIe 2.x), and some healthy upgrade potential.

Now, let's move up the ladder a bit. Hopping across to ***www.overclockers.co.uk****, I've configured a version of the Titan Bayonet mid-range gaming PC. Listed below is what £1,008.95 will bag you.*

- ***CPU:*** *Core i5-6600K (quad-core, 3.5GHz (overclocked to 4.4GHz)).*
- ***Cooler:*** *Alpenföhn Matterhorn Pure.*
- ***Motherboard:*** *Gigabyte GA-Z170-Gaming K3.*
- ***RAM:*** *2 × 4GB Corsair Vengeance LPX DDR4-2400.*
- ***GPU:*** *6GB Zotac GeForce GTX 1060.*
- ***SSD:*** *500GB Samsung 850 Evo.*
- ***PSU:*** *generic 550W (80 Plus Gold).*
- ***Case:*** *Phanteks Eclipse P400.*
- ***OS:*** *none.*

My own costing for that lot, with parts mostly from www.ebuyer.com but also a few from www.overclockers.co.uk, comes to £879.21. That's with an Antec PSU, not some generic effort. Self-building could therefore save you nearly £130, or 13%. Not to be sniffed at. With the change you could upgrade to a GeForce GTX 1070 or an NVMe M.2 SSD, perhaps, or maybe grab a new monitor.

All in all, then, Joel, the story's the same as it's been for several years. At the low-end, self-building makes no sense, not unless you want the sense of achievement that comes from bolting it all together and creating something through your own toil (and why not?).

However, at the higher-end – gaming rigs and systems for niche endeavours (Photoshop, say) – self-building is the logical path. Not only are there pennies to be saved; you also get to tailor the PC to your exact requirements, right down to the colour of the screws. The downside is that a fair bit of knowledge is needed – what works well with what, what all the specs and numbers mean – and

Is self-building worth the effort, and is there money to be saved?

Mobility Scheme

I'm very happy with my Lenovo ThinkPad T60 – it's been super-reliable for the last four year. Yet all good things must come to an end. It's currently running Windows 7, and I want to upgrade to Windows 10, but Microsoft's upgrade adviser gives the following warning about the Mobility Radeon X1400: 'The display manufacturer hasn't made your display compatible with Windows 10.'

So it's time to buy a new laptop. Could you recommend something more modern than the T60 but which still has a similar 'brick outhouse' construction? It'll need to last a good few years and be sensible priced. I've looked at some of Lenovo's current 'industrial' offerings, and they're beyond my budget. Realistically, I'm looking to spend up to about £300.

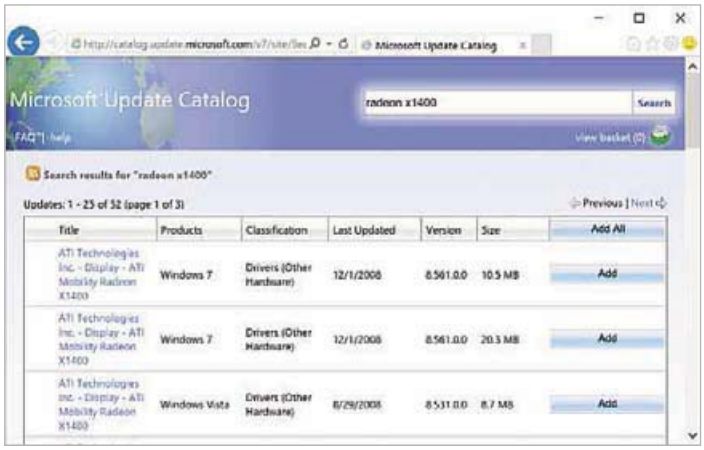
Huw Morgan, via email

Don't give up on your old Lenovo just yet, Huw. It's true that AMD doesn't officially support the Mobility Radeon X1400 under Windows 10, but take a look at this thread on the Windows 10 Forums (nothing to do with Microsoft): ***goo.gl/2ETpFK****. It seems that the Windows 7 driver may well be a goer.*

It doesn't much matter how you get hold of this driver, but one way is to tap into the Microsoft Update Catalog: ***goo.gl/mgcykC****. This is accessible only under Internet Explorer – even Microsoft's new Edge browser is blocked. Oddly, so is Internet Explorer 11, at least under Windows 10. Maybe this works under Vista, 7, or 8.x, or maybe an earlier version is required. Or maybe Microsoft has simply pulled the site completely. Who knows? If all else fails, just search for the X1400 driver in Google instead.*

To install the driver, don't run the usual setup program. Rather, Huw, decompress the file's contents (it'll just be an executable .zip package) and point Windows' 'Have Disk' wizard to the relevant .inf file. I won't go into details about that here, as there's a step-by-step guide at the end of the link I've given above. More help is also available via the Microsoft Community: ***goo.gl/xbMVW8****. Remember that there may be different drivers for 32-bit and 64-bit. Good luck!*

Does this facility even exist any more?



Bank Account

I've been sucked into the Pokémon Go craze and I need help! In short, my Galaxy S5's battery lasts less than 90 minutes. I've bought some replacement batteries, but these don't fare any better. I guess you get what you pay for. I think the solution is to buy one of those power-bank or emergency-charger things. Would a 10,000mAh one fit the bill? How long would it last – twice as long as a 5000mAh one? I'd be grateful if you could recommend some decent models. I don't want to buy a duffer.

C Roberts, Gmail

I understand that using the milliamp-hour (mAh) to measure battery capacity is incorrect. I don't know much about that, but using it that way is extremely common. Essentially, a 10,000mAh battery, at its given voltage, will be able to deliver a current of 10,000mA, or 10A (a milliamp is a thousandth of an amp), for one hour. It's a linear measure so, yes, in the same device and with everything else being equal, a 5,000mAh battery would last half as long and a 20,000mAh battery would last twice as long.

Of course, the Galaxy S5 doesn't draw anywhere near 10A. If it did, it would gobble an insane 37 watts – 3.7V × 10A. Even under heavy load, it consumes only about 5W – below 1W when idle. As the standard S5 battery is rated at 2,800mAh, you should expect a 10,000mAh power-bank to give about three full charges or to last as long as another three standard batteries if left plugged in (inefficiencies mean you'll never get the total advertised capacity).

As for which bank to buy, there are many nasty ones. Exercise caution. If you want to avoid a ton of research, it's unlikely you'll go wrong by sticking to units from EasyAcc, Anker, or Zendure (that's not to say all other brands are rubbish). In Anker's PowerCore range, the 10,000mAh model costs about £22 and the 20,100mAh model costs about £35.

As Pokémon Go is probably the most energy-hungry app going – as you've found – a bigger capacity is better, but bear in mind portability. You'll want something that'll sit unnoticed in a pocket. Also, look into any special features you might find desirable – fast charging, multiple USB ports, solar panels, and all the rest. Here's hoping you find or hatch a Lapras and take ownership of some gyms!

A power-bank is just the ticket for holidays, festivals, camping, walking, and any other activities involving long spells away from the national grid

Crowdfunding Corner

Your smartphone is more versatile than you probably realise, which is why this month we've selected a pair of crowdfunding projects that highlight its capabilities beyond just sitting in your pocket...

The Superbook

Suggested to us on Twitter by @thetippon (thanks!), the Superbook is an awesome-looking device, which uses the computing power in your smartphone to run a laptop. The shell consists of a full-size 11.6" screen, keyboard and trackpad, ten-hour battery and charger. Plug your Android smartphone into it, and you get an instant laptop, with the phone used for storage and processing.

The Superbook supports all modern Android devices – anything that supports USB-OTG technology (as most do). The battery charges your phone, and the keyboard has built-in Android navigation keys. Internet connectivity is provided by your phone's wi-fi or mobile data signal. It means you're able to work, play, watch TV or just browse the internet on your phone as if it was a full-size laptop – which is, of course, how much power it contains.

The project has already been a huge hit to the point (it's on the cusp of $1m after seeking just $50k) where stretch goals are being added, and we can't say for sure what they'll get by the end, but international keyboard decals, an extra USB port and a bigger battery have already been added, and an optional 1080p screen option seems certain. You can get a Gold Superbook Basic package (Superbook, package and power adapter) for $99 (£75) or a Superbook Special in Blue or Gold for $159 (£121), which also includes a universal sidemount and a multi-USB cord. The devices are planned to ship in February 2017.

URL: kck.st/2ahXn8m
Funding Ends: Saturday, 20th August 2016

Put2Go In-Car Mount

Last week we looked at a bicycle mount for your smartphone. This week: one for your car. The Put2Go is a magnetic phone dock that can also wirelessly charge your phone while it's mounted. Attaching to the fan vents of any standard car, the Put2Go holds your phone firmly in place while also charging any Qi-compatible device. You can use it as a satnav, music player or as any other (driving-safe!) device.

The Put2Go comes with magnetic mounts compatible with almost any breed of smartphone, and a USB cable so you can power it. If you spend more, you can get multiple mounts (in case you have more than one person driving your car!), as well as a desk mount so you have somewhere to rest your phone all the time.

The project has already hit its $24,000 goal and, at time of writing, there are almost two months to go, so it should be a big success. The standard kit (one mount and the dock) can be bought for a pledge of $59 (£45) and will ship in November 2016. The Bonus Kit, which comes with two mounts, the dock and a desk base, costs $99 (£75) and ships at the same time. Looks good to us.

URL: kck.st/2ayyY1T
Funding Ends: Tuesday, 20th September 2016

Disclaimer: Images shown may be prototypes and Micro Mart does not formally endorse or guarantee any of the projects listed. Back them at your own risk!

App Of The Week

Little Bit Of The Tour

We mount our velocipedes and wrestle with a tyre pump this week

The Tour de France is a gruelling, leg-burning, 23-day, 2,000-mile ride that pushes the limits of human endurance and the limits of our engineering and ingenuity. I get breathless cycling down to Asda for hummus.

Those of you who are avid cycling fans and a heck of a lot healthier too will no doubt be glued to the various stages as the teams and individuals make their way through some of the most scenic and splendid countryside France has to offer. But have you ever fancied giving it a go yourself?

Skoda

Skoda, the car manufacturer that everyone found amusing to poke fun at years ago, has created a web app called a Little Bit of the Tour.

What the company has done is set up a portal where you can enter your postcode and the distance you're willing to travel to match any of the stages of 'Le Tour' with your local area. While the setting of Barrow-in-Furness may not match the historic beauty of Mont Saint-Michel, you can at least take in the more painful aspect that will, in part at least, emulate what the actual riders may be going through.

Once you've got your route, grab a bottle or two of water and off you go. The routes appear to be quite friendly, meaning you won't suddenly find yourself going down the slip road on to the M6, and they'll incorporate various gradients from a chilled 1% to light and middle inclines, to something a little more severe.

Once you've completed your route, you can then share it via Facebook or Twitter, save the route and perhaps attempt another – although you may need a rest and a hot bath in between.

The aim of the web app is to give cyclists an equivalent experience, one that matches at least 80% of what a Tour de France cyclist may endure during the race.

Features At A Glance

- Free.
- Still in beta, but the mapping is certainly accurate.
- Customise your own stages of Le Tour.
- Share your experience on Facebook or Twitter.

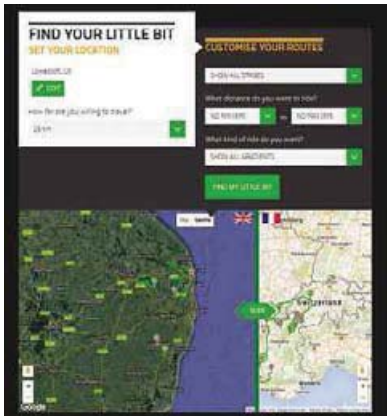
On Yer Bike!

Are you up for trying out a Little Bit of the Tour? Are you able to test your physical and mental reserves and put yourselves in the clip-on shoes of the incredible athletes who are currently burning about a million calories a minute?

On the other hand, the Skoda Le Tour web app is a pleasant experience that adds a little extra fun and gets you out and about. Plus it must be better than searching for Pokemon – unless Skoda incorporates a Mario Kart augmented reality element into it.

Either way, check it out at **goo.gl/AicLBf**. mm

Enjoy your own Tour de France



Set your location and route customisation and off you go

Logging Off

By the time you read this the guillotine will have come down on the Windows 10 free update year. According to Microsoft, 350 million devices use its latest OS now. Confusingly, however, that number doesn't directly correlate to users. In fact, nothing about the reporting of Windows 10's user base is transparent, because that number also includes Xbox consoles, phones, tablets and computers that haven't actually sold yet, though they have activated installation on them.

I myself have three computers with Windows 10 on them, but I can only use one at a time... And then only when I'm not using my Windows 7 work machine.

As a person who follows Microsoft closely it strikes me that, as good as 350 million sounds, it doesn't quite fit with what Terry Myerson, Executive Vice President of the Windows and Devices Group, shared in April last year. He said, "Within two to three years of Windows 10's release, there will be one billion devices running Windows 10,"

Skipping over the vague 'two to three years' timeframe, however you cook these numbers it has been obvious for a while that reaching the billion device target was going to be a stretch, if not utterly impossible, within that time window. So, how did Microsoft confront this embarrassment? With a two-pronged attack that both explained away the shortfall, and avoided coming back to it for an ongoing measure of their failure.

The admission came from a spokesman who wasn't Myerson, who said: "We're pleased with our progress to date, but due to the focusing of our phone hardware business, it will take longer than FY18". That's slightly comedic, and amounts to pinning the billion device tail on the phone donkey. Even Microsoft's most outrageous hyperbole didn't imply that its phone market share would contribute massively to the Windows 10 device breakdown – and the firm knew that project had abysmally tanked long before the billion device announcement. The truth is that the PC market is shrinking and not as many people took the free upgrade as Microsoft expected, possibly because of how pushy Microsoft got.

This creates a problem for CEO Satya Nadella because he's a bit sick of Google saying it has 1.5 billion registered Android devices, and not having an equally impressive number to throw back at them! The answer, it seems, is to count Windows 10's success

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in a totally new way, one that doesn't involve Terry Myerson showboating with unrealistic objectives. Instead, Satya told Wall Street in a quarterly earnings call that they'd change how they now start tracking monthly active users and provide those figures on a "regular" basis ('regular' probably coming down to whenever someone in the company works out how to present the numbers in a positive light).

A jump from 350 million devices to 150 million actual users could look really bad on paper. Considering that it's generally accepted that 50% of all Windows users are still using version 7 – and, with roughly 1.25 billion Windows PC's in use – it would aslo mean Microsoft still has a mountain to climb.

While I can follow its new strategy, what evades me is why they let Myerson say something so unbelievably stupid in the first place? A company falling foul of metrics created by others is one thing but, when it fails its own fabricated standards, that's pure comedy gold.

Mark Pickavance

LAST WEEK'S CROSSWORD

Across: **7** Law Of Averages, **8** Enigma, **9** Impose, **10** Swindle, **12** Trial, **14** Slash, **16** Pioneer, **19** Canada, **20** Da Capo, **22** Calligra Suite.
Down: **1** RAIN, **2** Gorgon, **3** Parable, **4** Gedit, **5** Casper, **6** Netscape, **11** Walk Away, **13** Sindbad, **15** Stable, **17** Noctua, **18** Range, **21** Path.

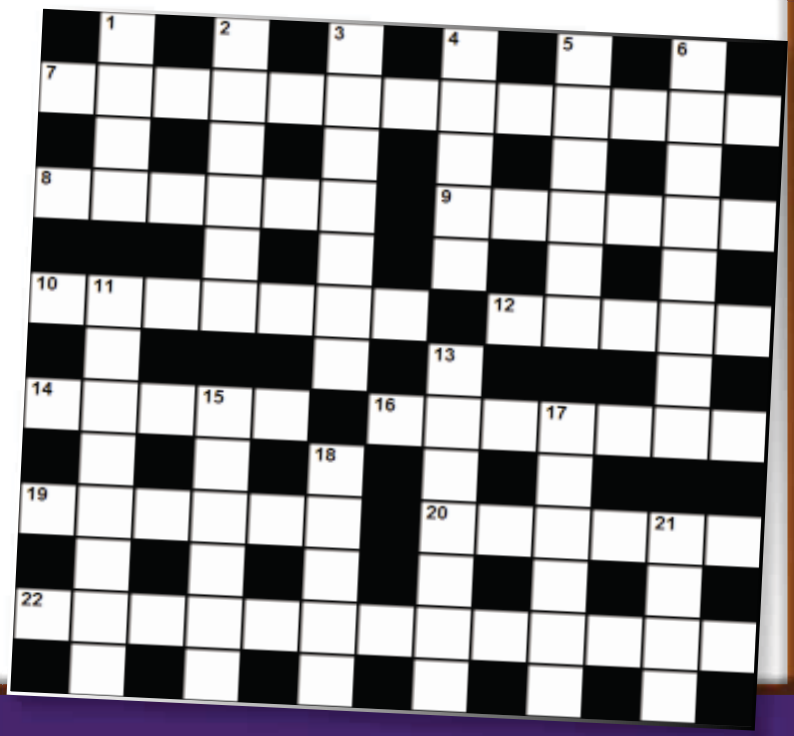
THIS WEEK'S CROSSWORD

Across

7 A public promotion of some product or service. (13)
8 A former line of small notebooks, categorized as netbooks manufactured by Hewlett-Packard. (2,4)
9 A cardinal number represented as 1 followed by 100 zeros. (6)
10 Affectionate term for a very studious and academic person. (7)
12 A children's card game, the object of which is to get rid of one's cards while making declarations about them which may or may not be truthful. (5)
14 A term used on interactive websites to describe an irritating or immature participant. (5)
16 An influential long-standing member of a UK political party. (7)
19 Born in 2041 this Tracy is the principal pilot of Thunderbird 2. (6)
20 The ratio of the adjacent side to the hypotenuse of a right-angled triangle. (6)
22 The practice of causing a webpage to rank highly in search engine results for unrelated or off-topic search terms by linking heavily. (6,7)

Down

1 Application protocol for querying and modifying data using directory services running over TCP/IP. (Acronym) (4)
2 The point in the sky or celestial sphere directly above an observer. (6)
3 Conforming to accepted standards of social or professional behaviour. (7)
4 The amount or manner in which something is used or consumed. (5)
5 Suavely charming in a way regarded as possibly insincere. (6)
6 Make changes in something established, especially by introducing new methods, ideas, or products. (8)
11 A gauge boson that mediates the weak gravitational interactions between particles. (8)
13 An officer at certain universities, appointed annually and having mainly disciplinary functions. (7)
15 Based in the United Kingdom this organisation promotes the visual arts through gallery education. (6)
17 A battle in 1645 that settled the outcome of the first English Civil War as the Parliamentarians won a major victory over the Royalists. (6)
18 This SQL statement changes the properties of an object inside a relational database. (5)
21 A logic gate which produces an output that is false only if all its inputs are true. (4)



DISCLAIMER
The views expressed by contributors are not necessarily those of the publishers. Every care is taken to ensure that the contents of the magazine are accurate but the publishers cannot accept responsibility for errors. While reasonable care is taken when accepting advertisements, the publishers cannot accept any responsibility for any resulting unsatisfactory transactions. John's back from his holiday, full of the joys of the British seaside; specifically, fish, chips and ice cream. He even managed to get a sun tan, which is a very hit and miss aspiration for a holiday spent on these shores. He's also glued to the internet having been largely bereft of wi-fi and decent mobile coverage in the quiet corner of Norfolk where he was hiding... Which must have amounted to something resembling cold turkey for him. He would probably tell you that he was ;digitally detoxing', but we'd wager he spent a decent proportion of his time wandering around trying to get a decent mobile data signal. Anyway, Tony's now off camping for the weekend soon, so we'll get to see how well he deals with the lack of wi-fi, PC, laptop, tablet, games console, Pokémon Go, PS Vita and whatever thing he's modded or hacked in the last month or two. Our guess is that his hands might be shakey before he hits that motorway. Really, making people like John and Tony travel further than their wi-fi networks reach is bordering on cruelty. Stay strong, boss... Stay strong.

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- Special issue! PC speed tips, watercooling, overclocking and more!
- How to copyright and trademark your content online
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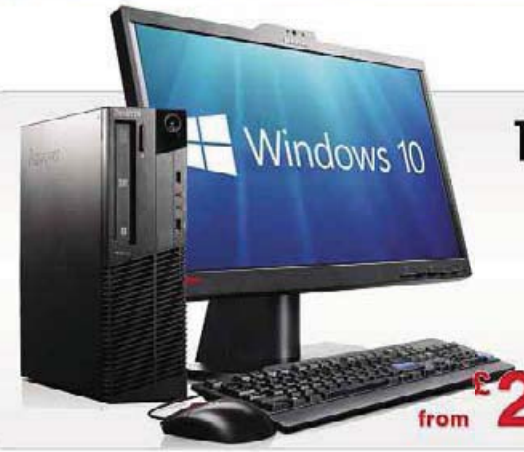

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